102676 ORIGINAL (1)3d)

BERKS SAND PIT RI/FS GRANULAR ACTIVATED CARBON TREATMENT SYSTEM CAPITAL COSTS
SC#.5438-17-SRI BERKGAC2.WK1

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	REFERENCE SOURCE	ITEM TOTAL ($)
1) EQUIPMENT MOBILIZATION	1	EA	$10,000.00	ASSUMED	10,000
2) SITE PREPARATION					
CLEAR AND GRUB (LIGHT TREES)	2	ACRES	$1,660.00	MEANS/SITE/021-104-0010	3,320
3) STORAGE TANKS	2	EA	$84,000.00	MEANS/SITE/132-051-0900	168,000
4) FOUNDATION - STORAGE TANKS	75	CYD	$148.30	MEANS/SITE/033-130-4050	11,123
5) SEDIMENT REMOVAL FILTERS	3	EA	$4,525.00	MEANS/MECH/152-184-8960	13,575
6) GRANULAR ACTIVATED CARBON UNITS	1	SKID	$90,000.00	VENDER QUOTE	90,000
7) PUMP	1	EA	$2,000.00	ASSUMED	2,000
8) (INTENTIONALLY BLANK)					
9) PIPE - 4"DIA. PVC	920	LF	$10.14	MEANS/CONS/151-551-1940	9,329
10) (INTENTIONALLY BLANK)					
11) PLUMBING FIXTURES AND RELATED					
GLOBE VALVES 4"DIA.	17	EA	$1,640.00	MEANS/MECH/151-980-3760	27,880
CHECK VALVES	5	EA	$1,115.00	MEANS/MECH/151-980-1460	5,575
TEES	4	EA	$103.00	MEANS/MECH/151-550-0890	412
COUPLINGS AT 10-FT.	92	EA	$23.08	MEANS/MECH/151-550-1160	2,123
90-DEG. ELBOWS	30	EA	$37.40	MEANS/MECH/151-550-2190	1,122
12) ELECTRICAL SYSTEM					
(A) M.C.C.-SIZE 1, 10 H.P.	1	EA	$720.00	MEANS/ELEC/163-110-0100	720
(B) STARTER-MAGNETIC 10 H.P.	2	EA	$545.00	MEANS/ELEC/89.2-730-0680	1,090
(C) PILOT LIGHT	2	EA	$94.00	MEANS/ELEC/163-110-1700	188
(D) PUSH BUTTON START	2	EA	$69.00	MEANS/ELEC/163-110-1800	138
(E) MOTOR INSTALLATION PACKAGE	2	EA	$1,320.00	MEANS/ELEC/163-110-0680	2,640
(F) MOTOR FEEDER	400	LF	$4.65	MEANS/ELEC/89.2-720-0360	1,860
(G) PUMP CONTROLLER UNIT	2	EA	$500.00	ASSUMED	1,000

ORIGINAL (Filed)

(H) HAND-HOLE BOXES	4	EA	$469.00	MEANS/ELEC/167-110-0600	1,876
(I) UTILITY TRENCH/BACKFILL	400	LF	$2.24	MEANS/SITE/12.3-110-1320	896
(J) CONCRETE CONDUIT BEDDING	15	CYD	$45.70	MEANS/SITE/033-122-0010	686
13)PRE-ENGINEERED BUILDING	1	EA	$67,278.00	(REFER TO DESIGN CALC.'S)	67,278
14)FENCING	300	LF	$8.57	MEANS/CONS/ 028-308-0200	2,571
15)FENCE GATE	1	EA	$152.00	MEANS/CONS/028-308-1400	152
16)PROFESSIONALS - ON SITE					
(A) HEALTH/SAFETY OFFICER	80	HOUR	$70.00	ESTIMATED	5,600
(B) CONST. INSPECTOR	400	HOUR	$60.00	ESTIMATED	24,000
(C) ENGINEER	100	HOUR	$70.00	ESTIMATED	7,000
17)TRENCHING, 6"DIA. PIPE SLOPE 0:1, 2-FT.WIDE, 6-FT.DEEP	400	LF	$4.17	MEANS/SITE/12.3-110-1340	1,668
18)BEDDING, 6"DIA. PIPE SLOPE 0:1, 2-FT.WIDE,8"DIA.PIPE	400	LF	$1.17	MEANS/SITE/12.3-310-1460	468
19)DEMOBILIZATION - AT 100% OF MOB.	1	EA	$10,000.00	ASSUMED	10,000
A) SUB-TOTAL (A)					474,289
B) SUBCONTRACTORS WORK ESTIMATED AT 20% OF SUB-TOTAL					94,858
C) FEE AT 10% OF SUBCON. WORK					9,486
D) SUB-TOTAL (B) = (A) + FEE					483,775
E) CITY INDEX COST ADJUSTMENT AT 0.949 AVERAGE FOR READING, PENNSYLVANIA APPLIED TO SUB-TOTAL (B)				BASED ON MEANS/SITE/CITY COST INDEX,APPENDIX(1988)	459,102
F) TOTAL ADJUSTED DIRECT COSTS (TADC)					459,102
G) INDIRECT CONTRACTOR COSTS AT 35% OF TADC				BASED ON MEANS/SITE/APPX	160,686
H) CONTRACTOR PROFIT AT 10% OF TADC + INDIRECT					61,979

I) TOTAL FIELD COST (TFC)	681,767
J) HEALTH AND SAFETY COST ALLOWANCE AT 5% OF TFC	34,088
K) CONTINGENCY COST AT 20% OF TFC	136,353
L) ENGINEERING COST AT 10% OF TFC	68,177
M) TOTAL CAPITAL COST TFC + H/S + CONT + ENG	$920,386

ORIGINAL (Signed)

SYSTEM: G.A.C. TREATMENT OPGAC2.WK1

BERKS SAND PIT ANNUAL OPERATION COSTS

NO.	ITEM DESCRIPTION	ANNUAL QUANTITY	UNITS	UNIT COST	ANNUAL COST
1)	MAINTENANCE LABOR				
	(A) PAINT TANKS	1.00	DAY	$400.00	$400
	(B) PUMP MAINTENANCE	40.00	HR	$25.00	$1,000
	(C) PUMP REPLACEMENT	0.10	EA	$250.00	$25
	(D) PIPING REPAIRS	1.00	DAY	$591.60	$592
2)	MAINTENANCE MATERIALS				
	(A) PAINT FOR TANKS	0.20	EA	$400.00	$80
	(B) PUMP REPLACEMENT	0.20	EA	$1,535.00	$307
	(C) PUMP MAINTENANCE	2.00	EA	$100.00	$200
	(D) PIPING REPAIRS	0.20	EA	$1,000.00	$200
3)	OPERATING LABOR				
	(A) OPERATOR	832.00	HR	$25.00	$20,800
	(B)				
4)	AUXILIARY MATERIALS/LABOR				
	(A) CARBON REGENERATION	12.00	EA	$29,460.00	$353,520
	(B) PAINT BUILDING	0.20	EA	$1,056.00	$211
	(C) REPLACE FILTER MEDIA	12.00	EA	$200.00	$2,400

ORIGINAL (red)

5) PURCHASED SERVICES				
(A) ELECTRICAL POWER	65,500.00	KW-HR	$0.07	$4,585
(B)				
6) DISPOSAL				
(A) DISPOSE FILTER MEDIA (DRUM INCINERATION)	10.00	DRUMS	$850.00	$8,500
(B)				
(C)				
7) ADMINISTRATION				
(A) ENGINEERING SERVICES				
PROFESSIONAL	160.00	HR	$45.00	$7,200
MANAGEMENT	40.00	HR	$75.00	$3,000
CLERICAL	40.00	HR	$25.00	$1,000
(B)				
8) INSURANCE,TAXES,LICENSES				
(A) INSURANCE	1.00	EA	$5,000.00	$5,000
(B) TAXES	1.00	EA	$1,000.00	$1,000
(C)				
9) OTHER COSTS				
(A) WEEKLY ANALYTICS	52.00	SAMPLE SETS	$150.00	$7,800
(B)				
(C)				
A) SUBTOTAL (A)				$417,820
B) CONTINGENCY COST				

AT 20% OF SUBTOTAL(A)				$83,564
C) SALVAGE AND DECOMMISSION: AT 100% CAPITAL COSTS INCURRED AT 30-TH YEAR, INTEREST = 10% ANNUAL SINKING PAYMENT	$1,137,138			$6,913
D) ANNUALIZED CAPITAL COST				$508,297
E) PRESENT WORTH AT 10% INTEREST AT 30 YEARS				$4,791,671

DISCHARGE TO STREAM

Baker Engineers

S.O. No. 15438-17- ORIGINAL 11:ed

Subject: BERKS SAND PIT
DISCHARGE SYSTEM
FS DESIGN

Sheet No. 1 of 5

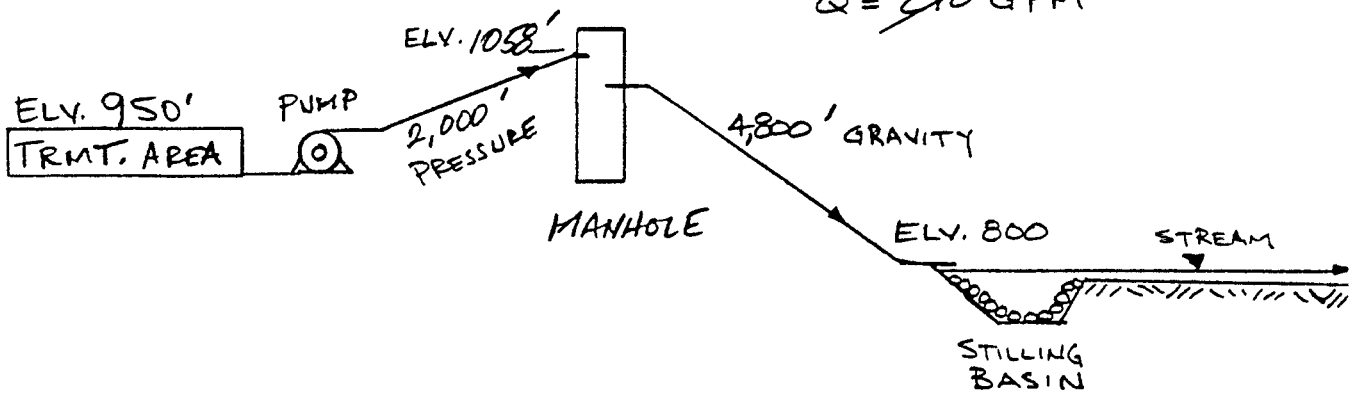
Drawing No.

Computed by LJS Checked By RPA Date 6/16/88

REVISED 10/11/88

(1) GENERAL SYSTEM LAYOUT

$Q = \cancel{210}\ 175$ GPM



(2) PRESSURE PIPE

PICK DRISCOPIPE HDPE 8600

PICK VELOCITY = 3 FPS

$$ID = 0.639\sqrt{\frac{\cancel{210}\ 175}{3}} = \cancel{5.346}\ 4.88" \text{ MIN.}$$

USE 6" NOMINAL ϕ DRISCOPIPE 8600 110 PSI RATED

ACTUAL ID = 5.771" SDR = 15.5

$\Delta P_{100}^{5.771"\phi}$ @ Q = 210 GPM = 0.23 PSI/100'

ΔH_{100} = 0.531 FT/100'

(3) TOTAL DYNAMIC HEAD

ELV. HEAD = (1058 - 950) = 108'

FRICTION = (0.531 × 20) ≡ 11 FT

MINOR = SAY 3 FT

AR301111

Baker Engineers

S.O. No. 15438-17-SR ORIGINAL (filed)

Subject: BERKS SAND PIT DISCHARGE SYSTEM FS DESIGN

Sheet No. 2 of 5

Drawing No.

Computed by LJS Checked By RFA Date 6/16/88

REVISED 10/11/88

④ PUMP SIZING / QUANTITY = 1 PLUS BACKUP (2)

$Q = \cancel{210}\ 175$ GPM

TDH = 122 FT.

$BHP = \left(\frac{\cancel{210}\ 175 \times 122 \times 1}{3960 \times 0.65}\right) = \cancel{9.95}\ 8.29$ BHP

$EHP = \left(\frac{\cancel{9.95}\ 8.29}{0.85}\right) = \cancel{11.7}\ 9.75$ EHP ~~KW LOAD = 8.7 KW~~

⑤ PUMP VENDER QUOTE — GOULD PUMPS

MODEL # SBF11635 @ FOB PITTSBURGH, PA

15 HP MOTOR 3 PHASE 200/230/460 V

1½" DISCHARGE 5 5/8" IMPELLER

2" INLET

$1,130 + Mag starter + 3 HEATERS

PEAK OPERATION 60% @ 125 FT 250 GPM

$1,130	PUMP
250	MAG. STARTER
300	3 HEATERS @ $100 EA.
$1,680	
100	PA TAX @ 6%
125	FOB SITE PLUS INSTALLATION
$1,905	TOTAL EACH
x 2	UNITS
$3,810	TOTAL

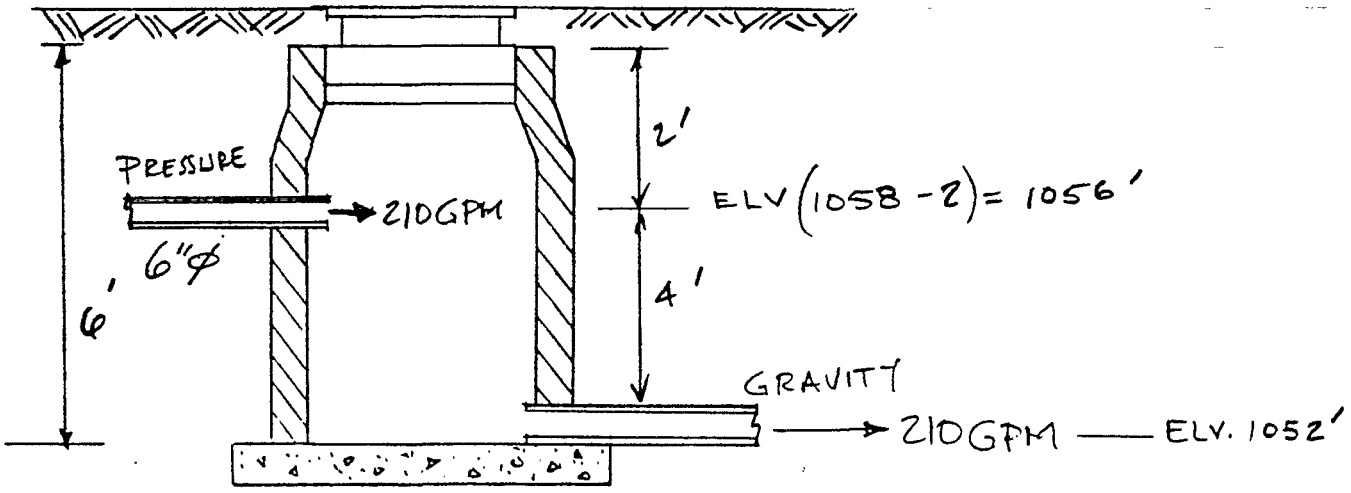
AR301112

Baker Engineers

S.O. No 15438-17- ORIGINAL (Filed)

Subject: BERKS SAND PIT
DISCHARGE SYSTEM Sheet No. 3 of 5
FS DESIGN Drawing No.
Computed by LJS Checked By GFF Date 6/16/88

(6) MANHOLES



MEANS/SITE/ 12.3-710-1980 $3,025

QUANTITY: (1 AS ABOVE) + (1 @ 500' DOWN HILL)

$\frac{4800}{500} \equiv (10 + 1) = 11 + 4$ AT BENDS

15 TOTAL

(7) GRAVITY FLOW PIPE

PICK: DRISCOPIPE 8600 HDPE 110 PSI RATING

$\text{SLOPE} = \left(\frac{1052 - 800}{4800/100}\right) \equiv 5.25$ FT/100'

Q = 210 GPM ID = 3.75" USE 6"ϕ NOMINAL
ACTUAL ID = 5.771

(8) TRENCH & BED

(2,000 + 4800) = 6,800 LF AR3 6' DEEP 3' x 2' WIDE

Baker Engineers

S.O. No. 15438-17-S ORIGINAL (Filed)

Subject: BERKS SAND PIT
DISCHARGE SYSTEM
FS DESIGN

Sheet No. 4 of 5

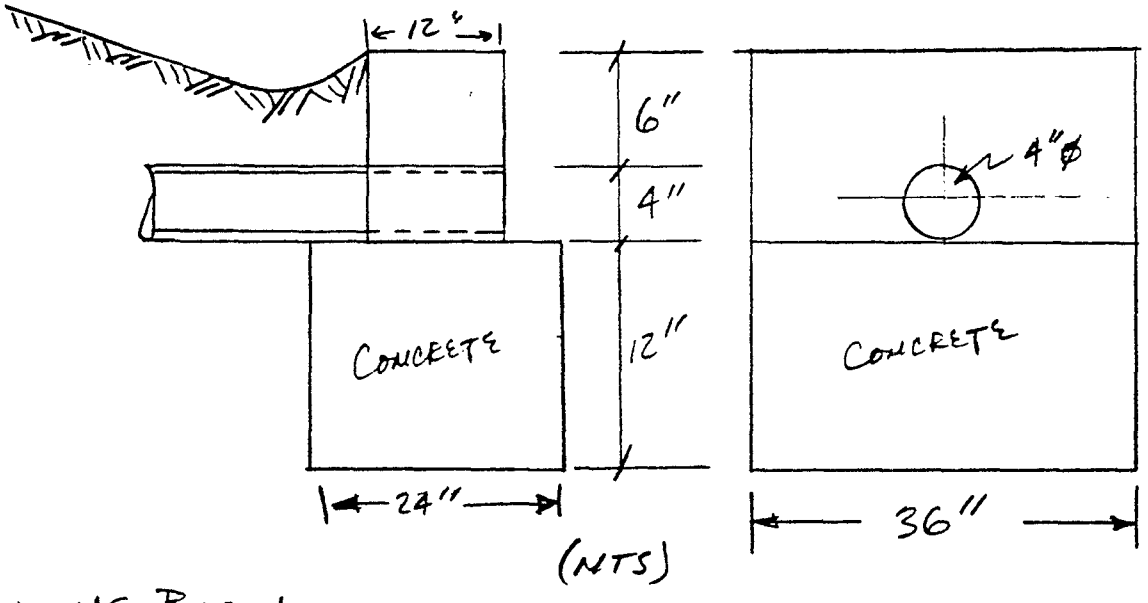
Drawing No.

Computed by LJS Checked By RPA Date 6/16/88

⑨ ENDWALL

USE: PENNSYLVANIA D.O.T.
STANDARDS FOR ROADWAY CONSTRUCTION
SERIES RC-0 TO 100
MAY 1983 PDT PUB. #72

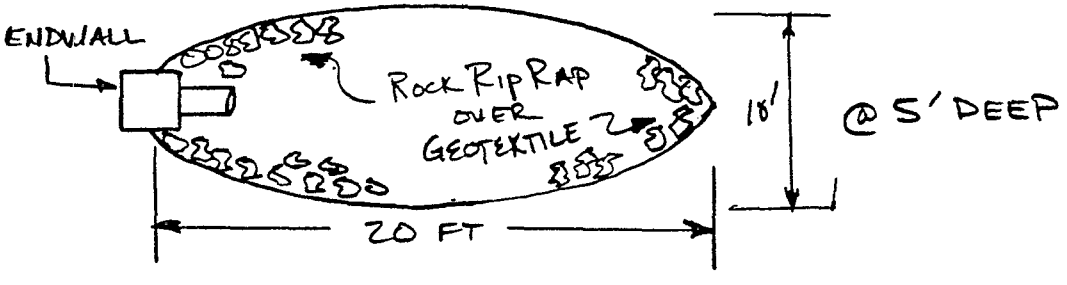
TYPE D ENDWALL RC-31



(NTS)

⑩ STILLING BASIN

USE: PADOT STANDARDS RC-70 ROCK BASIN



(NTS)

$V \approx \frac{\pi}{6}(20')\left(2 \times 10^2 + 5^2\right) \equiv 90$ CYD

AR301114

Baker Engineers

S.O. No. 15438-17 - ORIGINAL (Filed)

Subject: BERKS SAND PIT
DISCHARGE SYSTEM
FS DESIGN

Sheet No. 5 of 5

Drawing No.

Computed by LJS Checked By RPA Date 6/16/88

(11) VARIOUS QUANTITIES

ENDWALL

CONCRETE $(3' \times 2' \times 1') + (3 \times 1' \times 1') = 9$ CFT $\equiv$ (1 CYD)

ASSUME MEANS/CONS/033-130-3800 $138.90/CYD
(INC'D MATL, LABOR, EQUIP)

RIP-RAP

1-FT THICK X 2FT (10')(5') $\equiv$ 315 CFT $\equiv$ 12 CYD

ASSUME MEANS/SITE/022-712-0100 $19.15/CYD
(INC'LD MAT'L, LABOR, EQUIP)

GEOTEXTILE

40 MIL NYLON MAT

ASSUME: MEANS/SITE/027-054-0180 $1.02/SFT
(INC'LD MAT'L, LABOR, EQUIP)

SAY 350 SFT

PIPE

6"Ø NOMINAL PVC 6,800 LFT SCH. 40

ASSUME MEANS/CONS/151-551-1960 $14.19/LF

BITUMINOUS ROADWAY

4,800 LF X 2 FT WIDE = $\frac{9,600 \text{ SFT}}{24 \text{ SFT}}$ = 400 "EQUIVALENT" SF TO 24' WIDE ROAD

4" PAVEMENT 4" GRAVEL BASE

MEANS/SITE/12.5-111-1550 $61.45 @ 400 LF

AR301115

Baker Engineers

S.O. No. 15438-17-SRI ORIGINAL

Subject: BERKS SAND PIT
STREAM DISCHARGE SYSTEM Sheet No. 1 of 2
FS- O&M COSTS Drawing No.
Computed by LJS Checked By RPA Date 6/20/88

REVISION DATE: 6/29/88
REVISION #2 10/11/88

① OPERATING LABOR (SAMPLE COLLECTION)

1 SAMPLE/~~WEEK~~ MONTH × ~~8~~ 12 HR/SAMPLE × 4.2 × 12 = ~~403~~ 604 HR/YEAR

~~403~~ 604 HR/YEAR × $ ~~50~~ 60/HR = $ ~~20,150~~ $36,240/YEAR

② ANALYTICS

NPDES PERMIT REQUIREMENTS

#24	TOC
5	CONDUCTIVITY
6	HARDNESS
9	Ammonia
20	T.K.N.
25	OIL/GREASE
6	D.O.
5	PH
13	TOTAL P
7	S.S.
6	V.S.S.
8	T.S.
150	METALS
15	BOD_5

$ ~~300~~ 200 TOTAL/SAMPLE

ASSUME ~~52~~ 26 SAMPLES/YEAR ≡ $ ~~15,600/YEAR~~

$ ~~200 × 26 = $ 5,200~~

REVISION #2:

4 SAMPLE/QUARTER
75 HR/QUARTER
4 QUARTERS/YEAR
} 300 HR/YR

300 HR/YR × $ 60/HR = $ 18,000

NPDES PACKAGE PRICE
VENDOR QUOTE: $ 1,165/SAMPLE

(4 SAMPLES/QUARTER × 4 × $ 1,165)
= $ 18,640
COST FOR ANALYTICS

TOTAL $ 36,640/YEAR

AR301116

ORIGINAL

Baker Engineers

S.O. No. 15438-17-SRI(FS)

Subject: BERKS SAND PIT
STREAM DISCHARGE SYSTEM Sheet No. 2 of 2
FS - O&M Drawing No.

Computed by LJS Checked By RPP Date 6/20/88

(3) PUMP O&M

REPLACE AFTER 5-YEARS

$\frac{\$ 1,905 + 250}{5 \text{ YR.}} = \$ 450/\text{YEAR}$

MAINTENANCE

$ 50/YEAR PARTS, ETC

16 HR/YEAR x $ 50/HR = $800 LABOR

(4) PIPING, MANHOLES, VALVES, ETC.

ALLOW $ 1,000/YEAR REPAIRS

(5) STILLING BASIN REPAIR, ETC.

ALLOW $ 200/YEAR REPAIRS

(6) DISPOSAL

MANHOLE, STILLING BASIN CLEAN-OUT

10 CYD/YEAR x $ 100/CYD = $ 1,000/YEAR

(7) ELECTRICAL COSTS

8.7 KW x 24 x 365 = 76,212 KW-HR/YEAR

@ $ 0.07/KW-HR $ 5,335/YEAR

(8) X (F/U, 30-YR, 10%) = $ 494,345 DECOMMISSIONING
164.491 $ X = 3,005/YEAR SINKING FUND

AR301117

ORIGINAL (Red)

BERKS SAND PIT RI FS STREAM DISCHARGE SYSTEM CAPITAL COSTS
SC#13408-17-SRI BERKDISC.WK1

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	REFERENCE SOURCE	ITEM TOTAL ($)
1) EQUIPMENT MOBILIZATION	1	EA	$5,000.00	BASED ON VARIOUS MEANS	5,000
2) DEMOBILIZATION EQUIPMENT & SITE CLEANUP AT 100% OF MOBILIZATION	1	EA	$5,000.00	ASSUMED	5,000
3) SITE PREPARATION CLEAR AND GRUB (LIGHT TREES)	5	ACRES	$1,660.00	MEANS/SITE/021-104-0010	8,300
4) PIPE, 6"DIA. PVC SCH. 40 TREATMENT AREA TO STILLING BASIN	6,800	LF	$14.19	MEANS/CONS.151-551-1960	96,492
5) PUMPS, 210 GPM AT 1[illegible]-FT. HEAD INC'LD MAG.STARTER/HEATER/FOB-SITE	2	EA	$1,905.00	VENDER QUOTE	3,810
6) TRENCHING, BEDDING, 6"DIA. PIPE 2-FT.WIDE, 6-FT.DEEP, BACKFILLED	6,800	LF	$5.34	MEANS/SITE/12.3-110-310	36,312
7) MANHOLES [illegible]	[illegible]	EA	[illegible]	MEANS SITE [illegible]	[illegible]
8) ENDWALL [illegible]	1	EA	[illegible]	BASIS.MEANS,CONS [illegible]	[illegible]
9) RIP-RAP ARMOUR, IN STILLING BASIN INCLUDES MAT'L AND INSTALLATION	[illegible]	CYD	[illegible]	MEANS SITE [illegible]	[illegible]
10)GEOTEXTILE - STILLING BASIN LINING 40-MIL,NYLON MAT, INSTALLED	350	SFT	[illegible]	MEANS/SITE/[illegible]	357
11)CONCRETE, FOR THRUST BLOCKS	20	CYD	$93.05	MEANS/SITE/033-130-4650	1,861
12)EXCAVATE STILLING BASIN	90	CYD	$5.03	MEANS/SITE/12.1-414-1000	453
13)PROFESSIONALS - ON SITE (A) CONSTRUCTION ENGINEER (INCLUDES:WAGE,SUBSITENCE,TRAVEL)	300	HOUR	$80.00	ESTIMATED	24,000
14)BITUMINOUS ROADWAY REPAIR 4"PAVEMENT OVER 4" GRAVEL BASE	400	LF	$61.45	MEANS/SITE/12.5-111-1550	24,580
					0
15)PRE-START UP WATER QUALITY TESTS BACKGROUND FOR NPDES PERMIT	1	EA	$2,000.00	ASSUMED	0 2,000
16)STREAM CHARACTERIZATION STUDY	1	EA	$10,000.00	ASSUMED	10,000
					0
17)PUMP ELECTRICAL SYSTEM (A) M.C.C.-25 HP,SIZE 2, 18" HIGH	1	EA	$769.00	MEANS/ELEC/163-110-0200	0 769

[illegible] MOTOR INSTALLATION SYSTEM	[illegible]	EA	$[illegible].00	MEANS ELEC/B[illegible]	1,[illegible]
A. SUB-TOTAL (A)					$247,693
B) SUBCONTRACTORS WORK ESTIMATED AT 20% OF SUB-TOTAL (A) FEE AT 10% OF SUB. WORK					 $49,539 $4,954
C) SUB-TOTAL (B) = (A) + FEE					$252,647
D) CITY COST INDEX ADJUSTMENT AT 0.949 AVGERAGE FOR READING, PENNSYLVANIA APPLIED TO SUBTOTAL (B)				BASED ON MEANS/SITE/CITY COST INDEX,APPENDIX(1988) FOR READING, PA	$239,762
E) TOTAL ADJUSTED DIRECT COSTS (TADC)					$239,762
F) INDIRECT CONTRACTOR COSTS AT 35% OF TADC				BASED ON MEANS SITE APPX.	[illegible]
G) CONTRACTOR PROFIT AT 10% OF TADC + INDIRECT					[illegible]
H) TOTAL FIELD COST (TFC)					[illegible]
I) HEALTH AND SAFETY COST ALLOWANCE AT 5% OF TFC					$17,802
J) CONTINGENCY COST AT 20% OF TFC					$71,209
K) ENGINEERING COST AT 10% OF TFC					$35,605
L) TOTAL CAPITAL COST TFC + H S + CONT + ENG					$480,662

ORIGINAL (Red)

AR301119

ORIGINAL (Red)

REV. 14-Oct-88 PAGE 1

SYSTEM: STREAM DISCHARGE SYSTEM DPDISC.WK1

BERM SEAL PIT ANNUAL OPERATION COSTS

NO.	ITEM DESCRIPTION	ANNUAL QUANTITY	UNITS	UNIT COST	ANNUAL COST
1)	OPERATING LABOR				
	(A) STREAM SAMPLING 1 SAMPLE/MONTH 1-HR/SAMPLE	144	HR	$50.00	$7,200
	(B)				
2)	MAINTENANCE MATERIALS				
	A) PUMP REPLACEMENT AT 5-YR. LIFETIME	1	EA	$450.00	$450
	B, PUMP MAINTENANCE	1	EA	$50.00	$50
	C PIPING, MANHOLES, STILLING BASIN, ETC	1	EA	$1,000.00	$1,000
3)	MAINTENANCE LABOR				
	A PUMP MAINTENANCE	20	HR	$50.00	$800
	B PIPING,MANHOLES,ETC.	80	HR	$50.00	$4,000
	(C)				
4)	AUXILIARY MATERIALS LABOR				
	A ANALYTICAL-LABOR REPORT MONITORING BI-WEEKLY	26	SAMPLES	$200.00	$5,200
	(B)				
	(C)				
5)	PURCHASED SERVICES				
	A ELECTRIC POWER	74,212	KW-HR	$0.07	$5,335
	(B)				

AR301120

5. OTHER a. DEBRIS FROM MANHOLES AND STILLING BASIN	10	CYD	$100.00	$1,000
b				
c				
7. ADMINISTRATION (A				
(B				
8. INSURANCE,TAXES,LICENSES (A				
(B				
C				
9. OTHER COSTS a. ENGINEERING - TO PREPARE NPDES REPORTS	100	HR	$45.00	$4,500
b				
c				
1. SUBTOTAL (A)				$25,735
B. CONTINGENCY COST AT 20% OF SUBTOTAL(A)				$5,147
C. DISPOSAL AND DECOMMISSION: AT 100% CAPITAL COSTS INCURRED AT 30-TH YEAR, INTEREST = 10% ANNUAL SINKING PAYMENT	$480,662			$2,922

D) ANNUALIZED CAPITAL COST				$38,604
E) PRESENT WORTH AT 10% INTEREST AT 30 YEARS				$367,916

INJECTION WELL SYSTEM

Baker Engineers

S.O. No. 15438-17-SR1 ORIGINAL

Subject: Beaks Sand Pit
Injection System

Sheet No. 1 of 7

Drawing No.

Computed by RPA Checked By CDB 10-12-88 Date 5/27/88

REV 9/27/88 RPA

Assumptions

- Injection wells are completed in fractured zones
- Assumptions for extraction system hold for injection system
- Gravity drives injection : Rate $\propto$ head build-up
- Total Quantity of Water to be injected = Quantity Extracted
  Rate of Injection = Rate of Extraction = 252,000 gpd
- T = 5440 gpd/ft
- I = 0.0025 ft/ft
- Assume a well Radius of 0.25 ft.

Objectives of Injection System:

1. The primary objective of the injection system is the discharge or disposal of the treated water generated by the extraction/treatment system
2. Secondary Objectives include:
   a. Flushing of contaminants towards extraction wells
   b. Creating vertical, upward gradients to retard downward movement of contaminants
   c. Use of injection to prevent complete dewatering of aquifer

The effectiveness of an injection system in obtaining the secondary objectives is difficult to assess because of the heterogeneity and anisotropy of the aquifer. Therefore the injection system will be designed according to the primary objective

ORIGINAL

Baker Engineers

S.O. No. 15438-17-SR1

Subject: Banks Sand Pit Injection System

Sheet No. 2 of 7

Drawing No.

Computed by RPA Checked By CDB 10-2-88 Date 5/27/88 REV 9/27/88

Screen length:

In general: the screen length of an injection well should be approximately twice that of an extraction well for the same pumping rate(1)

Screen length of extraction system:
(50 + 70 + 150) 5 = 1350 feet.

Estimated Screen length of Injection System:
250ft x 5 = 1250 feet.

Other requirements/Considerations

- Injection wells should be deeper than extraction wells with deeper screened intervals.
- The bedrock is likely to be less fractured with increasing depth

1. Johnson Division (1986) Groundwater and Wells.

ORIGINAL

Baker Engineers

S.O. No. 15438-17-SR1

Subject: Berks Sand Pit Injection System

Sheet No. 3 of 7

Drawing No.

Computed by RPA Checked By CDE 10-12-88 Date 5/27/88

Rev 9/27/88 RPA

Assume a system that is approximately symmetrical to the extraction system:

Number of wells = 5
Injection Rate/well = 35 gpm
Diameter = 6 inches
Depth = 500 ft with 250 ft of screen

Radius of Influence (Refer to pumping system)

From $S_2 = S_1 - \frac{Q}{2\pi T} \ln(r_2/r_1)$

$\ln r_2 = \frac{(S_1 - S_2)2\pi T}{Q} + \ln r_1$

where

Q = pumping rate (gpd) = 50400 gpd
S_1 = drawdown at single pumping well = 15.9 ft
S_2 = Zero drawdown
T = transmissivity = 5440 gpd/ft
r_1 = radius of pumping well = 0.25 ft
r_2 = radius of influence (ft.)

So

$$\ln r_2 = \frac{(15.9-0)2\pi(5440)}{50400} + \ln(0.25)$$

$\ln r_2 = 9.3968$

$r_2 = 12,050.$ ft → 12050 feet.

Baker Engineers

S.O. No. 15438-17-SR1

Subject: Berks Sand Pit Injection System

Sheet No. 4 of 7

Drawing No.

Computed by RPA Checked By CDB 10-12-88 Date 5/27/88

REV 9/27/88 RPA

Head Build-up in Recharge Well

$$Q = \frac{T(h-H_o)}{528 \log(r_2/r_1)}$$

where h = head build-up in injection well (ft)

H_o = static head before injection (ft) : ASSUME A DATUM of 0 feet.

r_2 = RADIUS of influence = 12050 ft.

r_1 = RADIUS of injection well = 0.25 ft.

SO

$$h = \frac{528Q \log(r_2/r_1)}{T} + H_o$$

$$h = \frac{528(35)\log(12050/0.25)}{5440} + 0$$

$h = 15.9$ feet.

Note that the head build-up for a single injection well equals the estimated drawdown for a single extraction well. According to (1) the screen length of the injection system should be twice that of the corresponding extraction system.

One way to accomplish this is to double the number of injection wells and half the injection rate for each well.

1. Johnson Division (1986) Groundwater and Wells

Baker Engineers

S.O. No. 15438-17-SR1

Subject: Beaks Sand Pit Injection System

Sheet No. 5 of 7

Drawing No.

Computed by RPA Checked By CDE 10-12-88 Date 5/27/88

REV 9/27/88 RPA

Doubling the above system gives:

Number of Wells = 10

Injection Rate/well = 17.5 gpm

Diameter = 6 inches

Depth = 500 ft

Screen length/well = 250 ft.

Total Screen length for All wells = ~~3000 ft.~~ 2 × 1250 ft = 2500 ft

(this is close to twice screen length of extraction system)

Radius of Influence

From $\ln r_2 = \frac{(S_1 - S_2) 2\pi T}{Q} + \ln r_1$

and from $\frac{Q}{S} = 2$ $\frac{15.9}{2} = S_1 = 7.95$ feet. (Refer to extraction.

so $\ln r_2 = \frac{(7.95 - 0) 2\pi (5440)}{25200} + \ln(0.25)$

$\ln r_2 =$ ~~2.0057~~ 9.3968

$r_2 =$ ~~8828~~ ft. 12050 ft

Head build-up: $h = \frac{528 Q \log(r_2/r_1)}{T} + H_0$ 12050

$h = \frac{528(17.5) \log(8828/.25)}{5440} + 0$

$h =$ ~~8.75~~ ft. 7.95 ft

SO USE 10 WELLS.

Baker Engineers

S.O. No. 15438-17-SR1

Subject: Berks Sand Pit Injection System

Sheet No. 6 of 7

Drawing No.

Computed by RPA Checked By CDB 10-12-88 Date 5/27/88

REV 9/27/88 RPA

Well Spacing:

- Assume minimum spacing between injection wells is 206 feet.

Referring to pumping system

if injection wells are in a line then the maximum estimated head build-up after 1000 days is:

$\frac{60.46}{2}$ = ~~30.23 feet~~ $\frac{43.41}{2}$ = 21.71 feet

wells should be placed in an arc upgradient from contaminated zone to flush contaminants towards extraction wells.

Baker Engineers

S.O. No. 15438-17-SR1

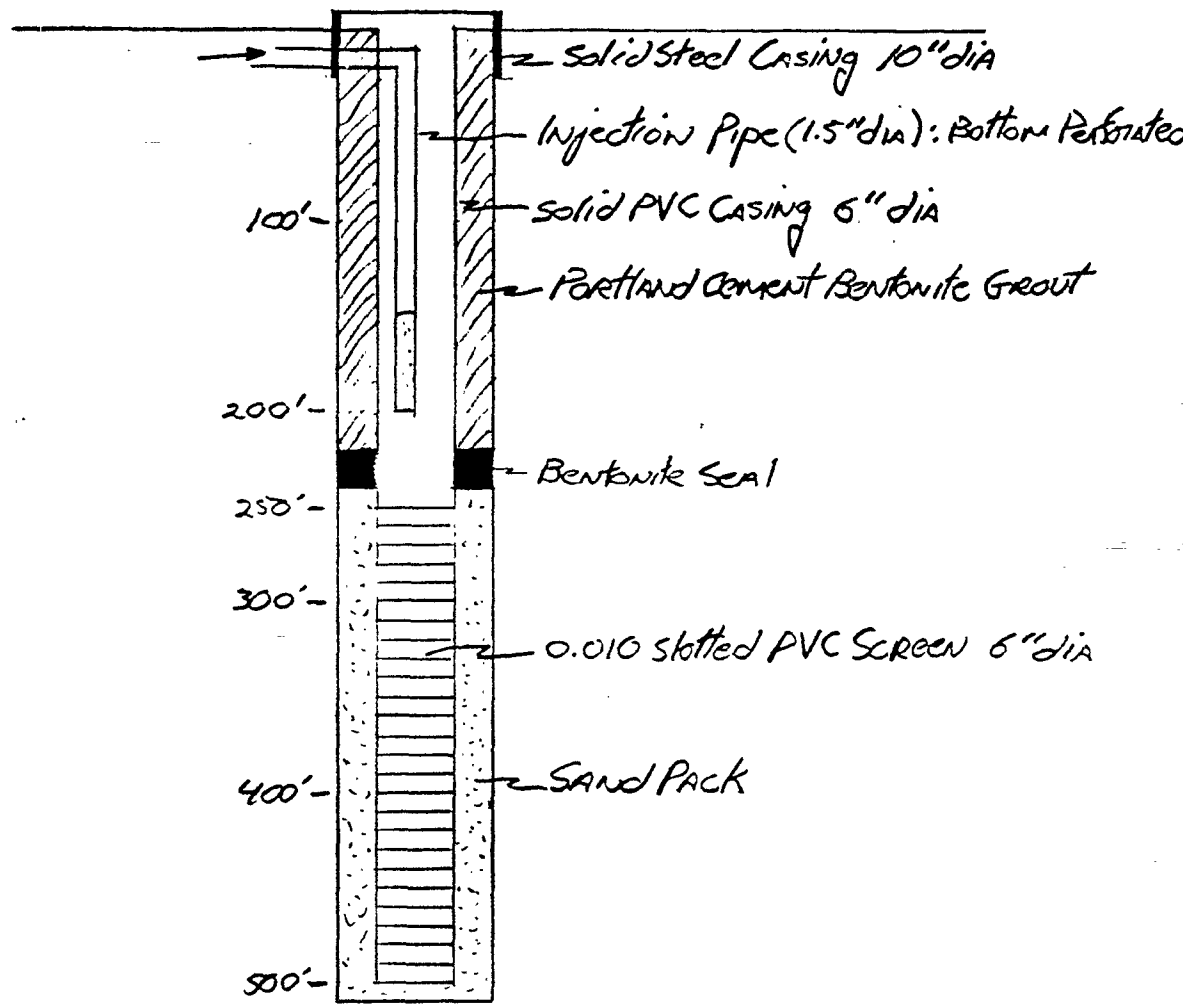
Subject: Berks Sand Pit
Injection System
Sketch of Injection Well

Sheet No. 7 of 7

Drawing No.

Computed by RPA Checked By [illegible] 10-12-88 Date 5/31/88

REV 9/27/88 RPA



Baker Engineers

S.O. No. 15438-17-SEI

Subject: BERKS SAND PIT
INJECTION WELL SYSTEM
CONCEPTUAL DESIGN

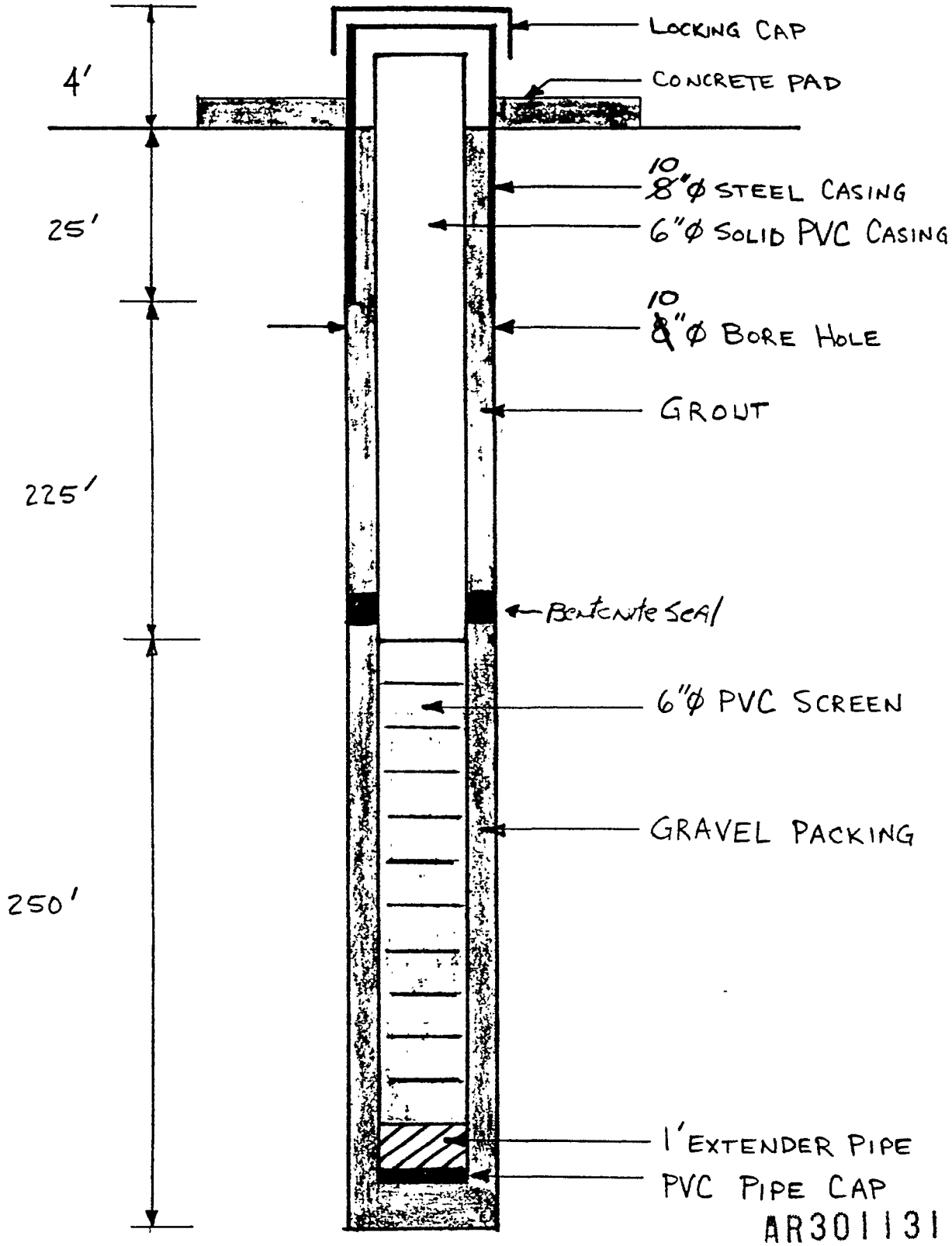
Sheet No. 1 of 14

Drawing No.

Computed by LJS Checked By RPA Date 6/9/88

REV 9/27/88 RPA

10
~~12~~ WELLS



Baker Engineers

S.O. No. 15438-17-SRI

Subject: BERKS SAND PIT
INJECTION WELL SYSTEM Sheet No. 2 of 14
CONCEPTUAL DESIGN Drawing No.

Computed by LJS Checked By RPA Date 6/9/88

REVISION DATE: 6/29/88
REV 9/27/88 RPA

(1) DRILLING, ~~8~~ 10" Ø HOLE

(~~12~~ 10 WELLS x 500') = ~~6,000~~ 5,000 VLF

(2) CORING, ~~2" Ø~~ NX ~~WITH SAMPLING~~

(~~4~~ 3 WELLS x 500') = ~~2,000~~ ~~1,000~~ 1500 VLF

(3) NUMBER OF CORING BOXES

(~~2000~~ 1500 VLF ÷ 12 FT/BOX) ≡ ~~170~~ 125 BOXES

(4) PIPE, ~~8~~ 10" Ø STEEL CASING

(~~12~~ 10 WELLS x 25') = ~~300~~ 250 LF

(5) PIPE, 6" Ø SOLID PVC CASING

~~(12 x 254')~~ ≡ ~~3,048~~ LF
10 x (255+5) = 2600 LF

(6) SCREENING, 6" Ø PVC FACTORY SLOTTED, FLUSH THREAD

(~~12~~ 10 x 250') = ~~3,000~~ 2500 LF

(7) CONCRETE PADS

~~12~~ 10 x (2' x 2' x 4/12') ≡ 1 CYD

(8) GROUT (PORTLAND CEMENT WITH 4% BENTONITE)

~~12~~ 10 WELLS x 250 LF x 0.785398 (~~8~~ 10/12² - 6/12²) ≡ ~~460~~ 873 CFT

USE 875 CF (~33 CY)

Baker Engineers

S.O. No. 15438-17-SRI

Subject: BERKS SAND PIT
INJECTION WELL SYSTEM Sheet No. 3 of 14
CONCEPTUAL DESIGN Drawing No.

Computed by LJS Checked By RPA Date 6/9/88
REV 9/27/88 RPA

(9) PORTLAND CEMENT (96% OF GROUT)

(~~460~~ 875 CFT x 0.96 x 196 PCF) ÷ 96 lb/bag ≡ ~~910~~ 1715 BAGS

(10) BENTONITE ~~PELLETS~~ POWDER (4% OF GROUT)

(~~460~~ 875 CFT x 0.04 x 80 PCF) ÷ 50 lb/bag ≡ ~~30~~ 56 bags

(10A) Bentonite Pellets (10 x 3ft x 0.355ft² x 80pcf) / 50 lb/bucket = 16.8 buckets (17 buckets)

(11) GRAVEL PACKING

~~12~~ 10 x 250' x 0.785398 (~~8~~ 10²/12 - 6/12²) ≡ ~~460~~ 875 CFT (~~17~~ 33 CYD)

(12) SINCE INJECTION WELLS ARE LOCATED OFF-SITE IN UNCONTAMINATED AREAS, DRILLING CUTTINGS WILL BE ASSUMED "CLEAN" AND DISPOSED ON-SITE.

(13) EQUIPMENT REQUIRED

2 DRILL RIGS
1 CEMENT MIXER 2CYD
1 BULLDOZER
1 BACKHOE
1 WELDING MACHINE
1 WATER TRUCK / FLATBED

(14) PROFESSIONAL FIELD STAFF

1 GEOLOGIST @ $~~60~~ 70/HR INCLUDING SUBSISTENCE, TRAVEL, ETC

(4 - MONTHS x 4.2 WKS x 5 DAYS x 8 HRS) ≡ 700 HRS.

1 CONSTRUCTION INSPECTOR ~~50~~ 100 HR @ $~~60~~/HR TOTAL

AR301133

Baker Engineers

S.O. No. 15438-17-SR ORIGINAL PROJ

Subject: BERKS SAND PIT
INJECTION WELL SYSTEM Sheet No. 4 of 14
CONCEPTUAL DESIGN Drawing No.
Computed by LJS Checked By RPA Date 6/9/88
Rev 9/27/88 RPA

(15) WELL DEVELOPMENT

USE ~~3~~ HR/WELL TO SET-UP & DEVELOP

$175/HR (LABOR, EQUIP, MAT'LS) - VENDER QUOTE

$(\cancel{10} \times \cancel{3} \times 175) = \$ \cancel{10,500}$ 5,250

~~(16) PACKER TESTS WILL NOT BE PERFORMED.~~

(17) PACKER TESTS

5~~6~~ TESTS @ 1 day PER WELL @ $150/HR (M, L&E INC'L)
TOTAL VENDER QUOTE

$(\cancel{5} \times 8 \times 150) = \$ \cancel{7,200}$ 6,000

~~REVISED to 32 tests~~
5 wells @ 5 test/well = 25 tests

WATER SHOULD NOT BE CONTAMINATED AND WILL BE DISCHARGED LOCALLY WHILE MONITORING.

(18) WELL CONSTRUCTION (LABOR ONLY - OTHER COSTS INCL'D ELSEWHERE)

ASSUME: 2-DAY PER WELL TO CONSTRUCT
(NOTE: DRILLING & MAT'LS INCLUDED ELSEWHERE)

MEANS: SITE CREWS B-43, 55, 61 (SELECT COMPONENTS)

0.5	LABOR FOREMAN	$74/DAY	BARE COSTS
3	LABORERS	398/DAY	
1	CEMENT MIXER	200/DAY	
		$672/DAY	

(24 DAYS x $672) = $16,128

(19) GEOPHYSICAL LOGGING & INVESTIGATION ALLOW $ ~~5,000~~ 25,000

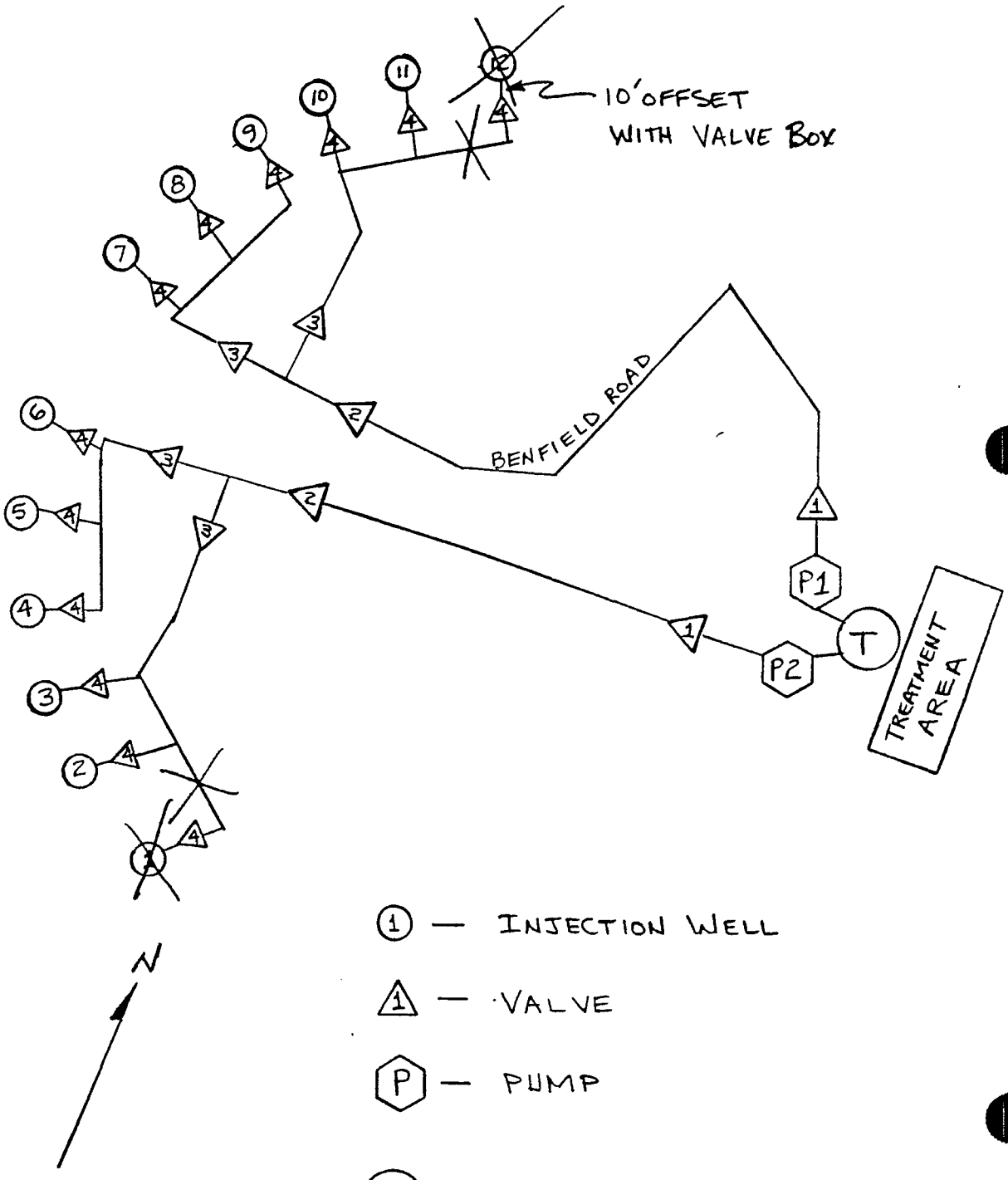
Baker Engineers

S.O. No. 15438-17-SR (Revised) ORIGINAL

Subject: BERKS SAND PIT
INJECTION WELL SYSTEM Sheet No. 5 of 14
CONCEPTUAL DESIGN Drawing No.
Computed by LJS Checked By RPA Date 6/9/88

REVISED 10/11/88

(20) GENERAL PIPING SYSTEM LAYOUT



Baker Engineers

S.O. No. 15438-17-SR1 (ORIGINAL Rec'd)

Subject: BERKS SAND PIT
INJECTION WELL SYSTEM Sheet No. 6 of 14
CONCEPTUAL DESIGN Drawing No.
Computed by LJS Checked By RPA Date 6/9/88

REVISED 10/11/88

(21) PIPE SIZING (PIPES NEED TO BE BURIED)

(a) MAIN LINES

FROM (P) TO (3)

$Q = \frac{175}{2}\text{GPM} = 87.5\text{ GPM}$ PICK: VELOCITY = 3 FPS

SPECIFY: DRISCOPIPE 8600 (HIGH DENSITY POLYETHYLENE)

REFERENCE: DRISCOPIPE SYSTEMS DESIGN MANUAL (1981)
PHILLIPS DRISCOPIPE COMPANY

$ID = 0.639\sqrt{\frac{Q}{V}} = 3.45''$

USE: 4"Ø NOMINAL 110 PSI RATING SDR 15.5
ACTUAL ID = 3.920"

$\Delta P_{100}^{3.920"\phi}$ @ Q = 105 GPM = 0.40 PSI/100'

ΔH_{100} = 0.924 FT/100'

(b) MANIFOLD LINES

FROM (3) TO (4)

$Q = \frac{105\text{ GPM}}{2} = 52.5\text{ GPM}$ V = 3 FPS

ID = 2.673"

USE: 3"Ø NOMINAL 110 PSI RATING SDR 15.5
ACTUAL ID = 3.048"

$\Delta P_{100}^{3.048"\phi}$ @ Q = 52.5 GPM = 0.25 PSI/100' AR301136

(c) SERVICE LINES

FROM (4) TO (1) THRU (12)

$Q = \frac{52.5\ GPM}{3} = 17.5\ GPM$ $V = 3\ FPS$

ID = 1.543"

USE: 1 1/2" Ø NOMINAL 110 PSI RATING SDR 13.1

ACTUAL ID = 1.610"

$\Delta P_{100}^{1.610"\phi}$ @ Q = 17.5 GPM = 0.90 PSI/100'

ΔH_{100} = 2.1 FT/100'

(22) PIPE QUANTITIES AND FRICTIONAL HEAD LOSSES

NOMINAL	QUANTITY	ΔH_{100}	HEAD LOSS (FT)
4"	2,500	0.924	23.1
3"	3,000	0.58	17.4
1 1/2"	120	2.1	2.5
1 1/2" * INJECTION LINE	2,550'	IGNORE	IGNORE

MAT'L → PVC PIPE ΣH_L = 43.0 FT.

* THIS PIPE EXTENDS DOWN THE INJECTION WELL APPROXIMATELY 200 FT. AND FRICTION LOSSES WILL BE COMPENSATED FOR BY ELEVATION HEAD GAIN.

ORIGINAL (Red)

S.O. No. 15438-17-SR

Subject: BERKS SAND PIT
INJECTION WELL SYSTEM Sheet No. 8 of 14
CONCEPTUAL DESIGN Drawing No.
Computed by LJS Checked By RPA Date 6/9/88

(23) PIPE FITTINGS AND MINOR HEAD LOSSES

NOMINAL	ITEM	APPROX. QUANTITY	K*	H_L
4"	90° ELLS - STD	30	0.51	2.14
	45° ELLS - STD	10	0.27	0.38
	BRANCH TEE - STD	2	1.02	0.29
	GLOBE VALVES (1)(2)	4	5.8	3.25
	SWING CHECK VALVES	2	1.7	0.48
3"	45° ELLS - STD	24	0.29	0.97
	BRANCH TEE - STD	12	1.08	1.81
	GLOBE VALVES - (3)	4	6.1	3.42
1½"	PITLESS ADAPTER 90° BRASS	12	0.63	1.06
	SWING CHECK VALVES	12	2.1	3.53
	GLOBE VALVES - (4)	12	7.1	11.93

$\Sigma H_L =$ 29.3 FT.

* FOR USE IN FORMULA $H_L = K \frac{V^2}{2g}$

$\frac{V^2}{2g} = \left(\frac{3^2}{2 \times 32.174}\right) = 0.14$

AR301138

Baker Engineers

S.O. No. 15438-17-SRI ORIGINAL (Red)

Subject: BERKS SAND PIT INJECTION WELL SYSTEM CONCEPTUAL DESIGN

Sheet No. 9 of 14

Drawing No.

Computed by LJS Checked By RPA Date 6/9/88

(24) PUMP SIZING AND SPEC'S

(a) ELEVATION HEAD

PUMP ELV. ~ 955'

HIGEST POINT IS AT INJECTION WELL (5)

ELV = 1056'

$$H_{ELV.} = (1056 - 955) = 101 \text{ FT.}$$

(b) TOTAL DYNAMIC PUMPING HEAD

$$TDH = (101 + 29.3 + 43.0) \equiv 175 \text{ FEET}$$

(c) HYDRAULIC HP

$$\text{MASS FLOW RATE} = (105 \text{ GPM} \times 8.345 \text{ lb}_m/\text{GAL})$$

$$= 876 \text{ lb}_m/\text{MIN.}$$

$$\text{HYD HP} = \left(\frac{876 \times 175'}{33,000}\right) = 4.65 \text{ HYD. HP}$$

(d) BRAKE HP

ASSUME 65% PUMP EFFICIENCY

$$\left(\frac{4.65}{0.65}\right) = 7.15 \text{ BHP MINIMUM}$$

(e) ELECTRICAL LOAD

ASSUME 85% MOTOR EFFICIENCY

$$EHP = \left(\frac{7.15 \text{ BHP}}{0.85}\right) = 8.42 \text{ EHP}$$

$$\text{KW LOAD TO MOTOR} = (8.42 \times 0.7457) = 6.3 \text{ KW}$$

ORIGINAL (Red)

S.O. No. 15438-17-SRI

Subject: BERKS SAND PIT
INJECTION WELL SYSTEM Sheet No. 10 of 14
CONCEPTUAL DESIGN Drawing No.
Computed by LJS Checked By RPA Date 6/10/88

(25) VENDER QUOTE ON PUMPS

MANUFACTURER : GOULD PUMP Co.

MODEL : #3656

FLOW : 105 GPM
HEAD : 185 FT. } 65% EFFICIENCY

SIZE : 1½ x 2 x 8

MOTOR : 10 BHP 3550RPM 3-PHASE

IMPELLER : 6¾"

BODY : CAST IRON

FITTINGS : BRASS

PUMP COST	= $1,000	FOB PITTSBURGH
+ MAG STARTER	= 200	
+ HEATERS (3)	= 100	(1 PER PHASE)
+ TAX	= 78	
+ TRANSPORT	= 50	EACH
EACH	$ 1,428	FOB SITE
QUANTITY	X 3	2 PUMPS PLUS 1 BACKUP UNIT
TOTAL	$ 4,284	

AR301140

Baker Engineers

S.O. No. 15438-17-SP (ORIGINAL TRAIL)

Subject: BERKS SAND PIT
INJECTION WELL SYSTEM Sheet No. 11 of 14
CONCEPTUAL DESIGN Drawing No.
Computed by LJS Checked By RPA Date 6/10/88

(26) ELECTRICAL AND INSTRUMENTATION

(a) EQUIPMENT

	QUANTITY		
ELECTRIC SERVICE	1	EA	
FEEDER TO PUMPS	100	LF	(ESTIMATE)
MOTOR CONTROL CENTER, ETC	1	EA	
MOTOR INSTALLATION	3	EA	
WELL FLOW CONTROL SYSTEM	12	EA	
PUMP FLOW CONTROL SYSTEM	2	EA	

(b) MOTOR CONTROL CENTER

(2 PUMPS x 10 HP/PUMP) = 20 HP

MEANS: ELEC. 163-110-0200
25 HP, MCC, SIZE 2, 18" HIGH

~~STARTERS (3)~~
~~MAGNETIC 10 HP SIZE 1~~
~~MEANS: ELEL 163-130-0200~~

(c) ELECTRIC SERVICE

3-PHASE 4 WIRE POWER FACTOR ≡ 0.80

$$\text{AMPS} = \left(\frac{2 \times 7.4 \text{ KW} \times 1000}{208 \text{ V} \times 0.80 \times 1.73}\right) = 51 \text{ AMPS}$$

USE: MEANS: ELEC B9.1-210-0220
60 AMP 3 PHASE 4 WIRE 120/208 VOLT

(d) ELECTRIC FEEDER (WIRE & CONDUIT W/ JUNCTIONS)

USE: MEANS: ELEC B9.1-310-0200 (60 AMP)

(e) MOTOR INSTALLATION

INCLUDES: SAFETY SWITCHES
MOTOR STARTER
CONNECTIONS & 50 LF CONDUIT
INSTALLATION

USE: MEANS ELEC B9.2-710-0680
3 PHASE, 200V, 10HP MOTOR

(f) WELL FLOW CONTROL SYSTEM (SEE SCHEMATIC page 13)

USE: MEANS: MECH 157-420-3650
ELECTRIC OPERATED PRESSURE SENSOR
(HIGH WATER LEVEL AND
LOW WATER LEVEL SENSORS)
2 PER WELL

USE: MEANS MECH 157-420-7240
ELECTRIC MOTOR ACTUATED VALVE
BRASS 2-WAY 1½" PIPE SIZE
1 PER WELL

USE: MEANS MECH 157-420-3460
SELECTOR RELAY, 3-WAY
1 PER WELL

USE: MEANS CON. 161-165-0030
No. 12 COPPER, SOLID THWN WIRE

ESTIMATE: 8,200 LF (82 CLF)

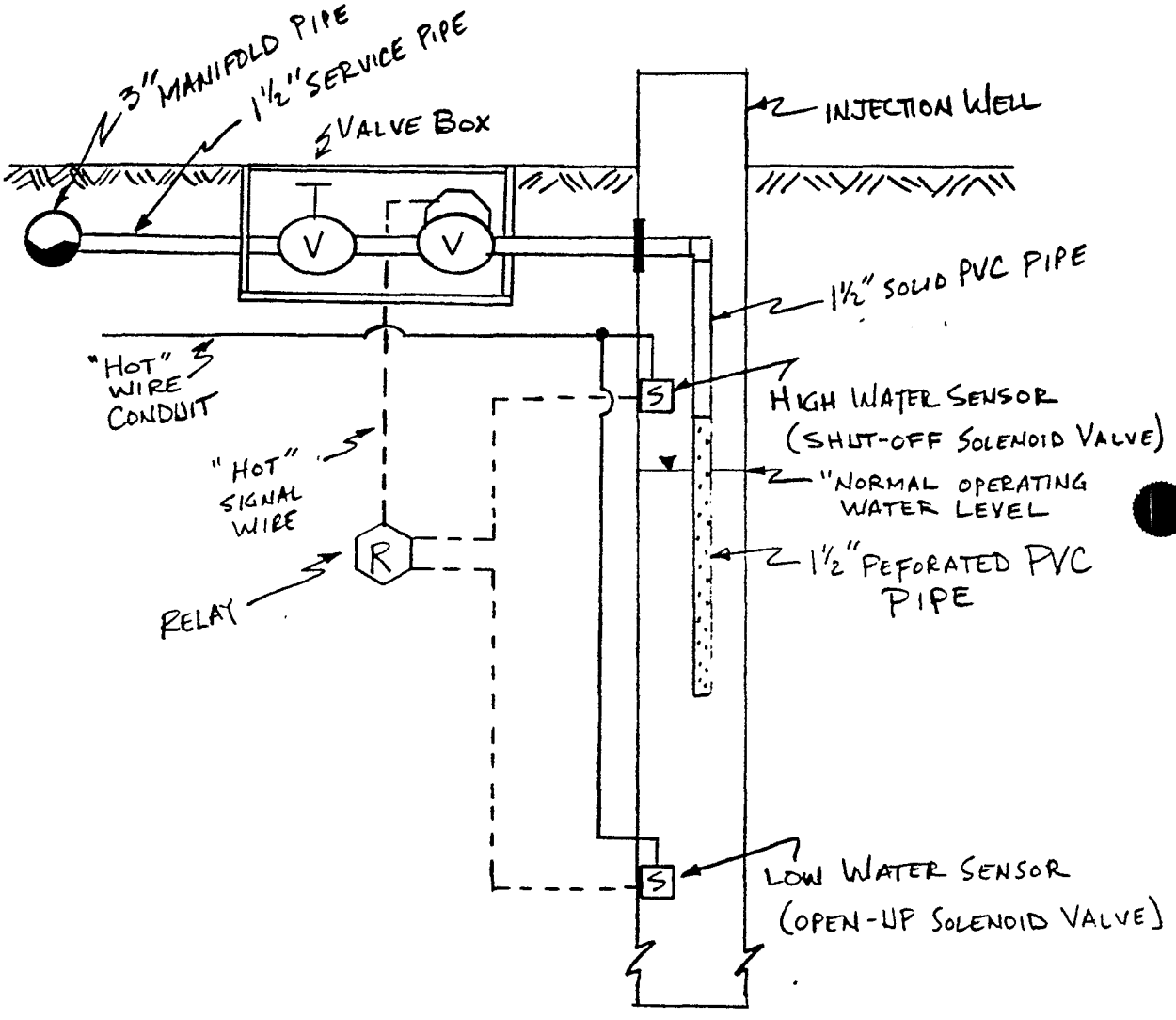
Baker Engineers

S.O. No. 15438-17-SRI ORIGINAL (Red)

Subject: BERKS SAND PIT
INJECTION WELL SYSTEM Sheet No. 13 of 14
CONCEPTUAL DESIGN Drawing No.

Computed by LJS Checked By RPA Date 6/10/88

(9) SCHEMATIC OF WELL FLOW CONTROL SYSTEM (NTS)



V – ELECTRIC MOTOR ACTUATED VALVE 1½"ϕ

V – MANUALLY OPERATED GLOBE VALVE 1½"ϕ

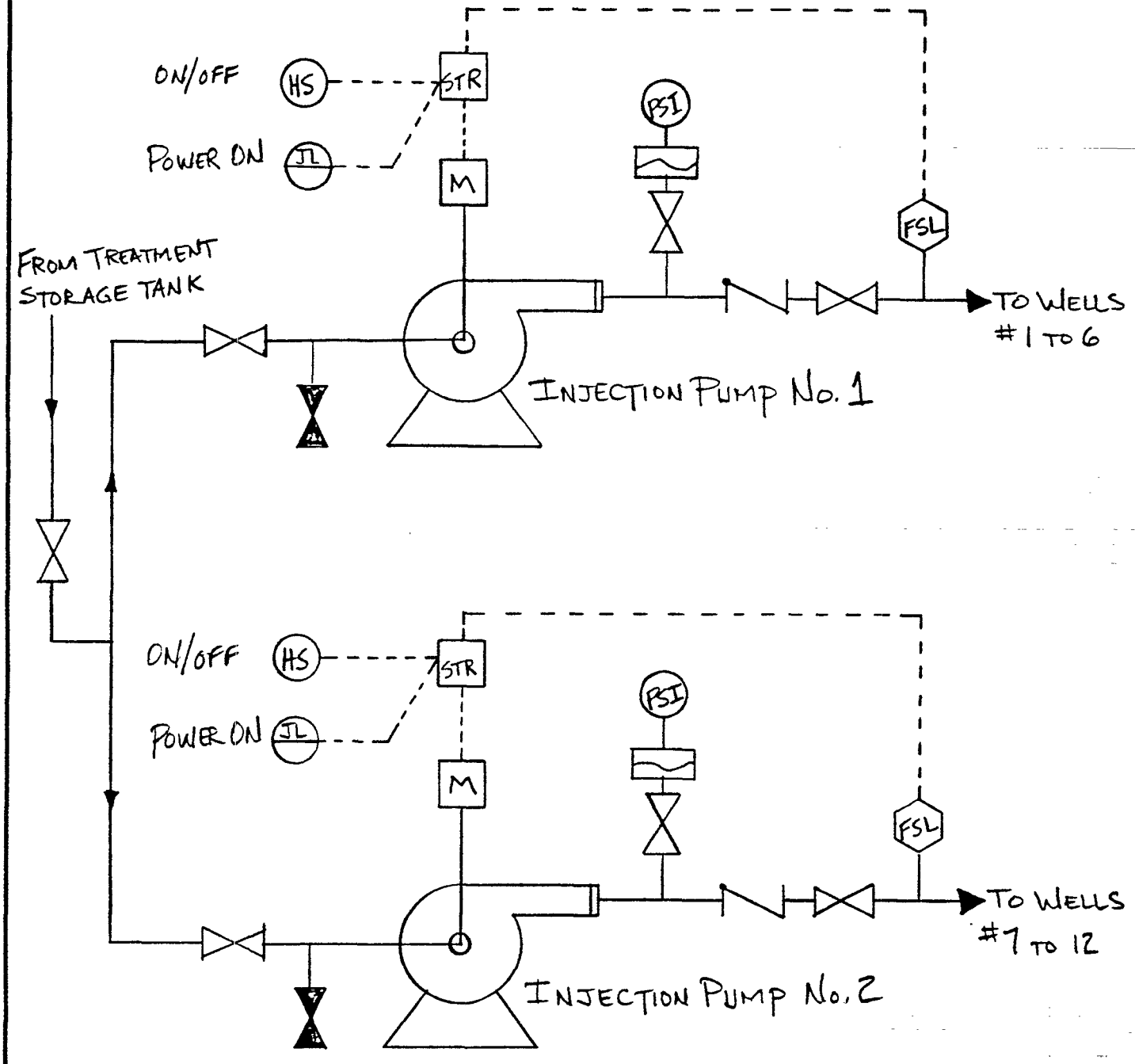
AR301143

ORIGINAL

S.O. No. 15438-17-SR (Rev)

Subject: BERKS SAND PIT
INJECTION WELL SYSTEM Sheet No. 14 of 14
CONCEPTUAL DESIGN Drawing No.
Computed by LJS Checked By RPA Date 6/10/88

(h) PUMP CONTROL SYSTEM SCHEMATIC



SYMBOLS

FSL FLOW SENSOR LOW

PSI PRESSURE GAGE

STR STARTER

HS HAND SWITCH

JL POWER

CHECK VALVE

S.O. No. 15438-17-SRI ORIGINAL (Rev)

Subject: BERKS SAND PIT
INJECTION WELL SYSTEM Sheet No. 1 of 2
FS - O&M COSTS Drawing No.

Computed by LJS Checked By RPA Date 6/20/88

REVISION DATE: 6/29/88
REVISION #2 10/11/88

(1) OPERATING LABOR

8 HR/WEEK x 4.2 x 12 ≡ 400 HR/YEAR

AT ~~$50~~ $25/HR ~~$20,000/YEAR~~ ~~$10,000~~

REVISION #2:
(10 HR/WK, 52 WK/YR, $25/HR) $13,000

(2) MAINTENANCE MAT'LS

(a) PUMP REPLACEMENT

ASSUME 5-YEAR SERVICE LIFE

(2 x $1,725/PUMP) = $3450 / 5-YR = $690/YR.

(b) PIPES, VALVES, ETC.

USE 4"Ø PIPE AS "AVERAGE"

$10.14	/LF	PIPE
4.17	/LF	TRENCH
1.23	/LF	BEDDING
20.00	/LF	FITTINGS ALLOWANCE
$35.54	/ LF	

ASSUME 200 LF/YEAR = $7,108

(c) PUMP MAINTENANCE

ASSUME $50/PUMP/YEAR PARTS, ETC. * 2 PUMPS

(3) MAINTENANCE LABOR

(a) PUMP REPLACEMENT

(2 x 250) / 5 = $100/YEAR

(b) PUMP MAINTENANCE

16 HR/PUMP x 2 x $50/HR = $1,600/YEAR

AR301145

Baker Engineers

S.O. No. 15438-17-SR ORIGINAL (Red)

Subject: BERKS SAND PIT
INJECTION WELL SYSTEM Sheet No. 2 of 2
FS - O&M COSTS Drawing No.

Computed by LJS Checked By RPA Date 6/20/88

④ ELECTRICAL COSTS

$0.07 KW-HR

7.4 KW x 2 x 24 HR x 365 = 129,648 KW-HR/YR.

$9,075/YEAR

⑤ { AUXILLARY EQUIP
DISPOSAL
ADMIN.
I, T, L } NOT APPLICABLE

⑥ DECOMMISSIONING

x (F/U, 30-YR, 10%) = $ 1,933,445
164.491

X = $ 11,754/YR SINKING FUND

AR301146

[illegible] SAND PIT INJECTION WELL SYSTEM CAPITAL COST PAGE 1 REV. [illegible]-88

[illegible] SAND PIT [illegible] INJECTION WELL SYSTEM CAPITAL COSTS
[illegible] FILE, [illegible]

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	REFERENCE SOURCE	ITEM TOTAL ($)
1) EQUIPMENT MOBILIZATION	1	EA	$10,000.00	ASSUMED	10,000
2 DRILL RIGS					
1 WATER TRUCK					
1 FLATBED TRUCK					
1 105 HP DOZER (<25 MILE MOB.)					
2) SITE PREPARATION					
CLEAR AND GRUB (LIGHT TREES)	5	ACRES	$1,660.00	MEANS/SITE/021-104-0010	8,300
3) DRILLING, 10" DIA. HOLE					
NO CASING, LABOR.EQUIP. ONLY	5,000	VLF	9.17	MEANS,SITE/026-704-0200	45,850
4) DRILLING [illegible]					
	[illegible]	VLF	[illegible]	MEANS,SITE [illegible]	[illegible],950
5) PIPE, [illegible] STEEL CASING	[illegible]	LF	[illegible]	MEANS SITE [illegible]	[illegible]
6) PIPE, [illegible] PVC [illegible] CASING	[illegible]	LF	[illegible]	MEANS SITE [illegible]	[illegible]
7) PIPE, [illegible] DIA. PVC SLOTTED SCREEN	2,500	LF	$14.50	VENDER QUOTE	36,250
8) [illegible] WELLHEAD STEEL CAPS	[illegible]	EA	[illegible]	ASSUMED	[illegible]
9) CONCRETE, FOR WELL CLUSTER PADS	1	CYD	[illegible]	MEANS SITE/[illegible]	[illegible]
10) PORTLAND CEMENT, FOR GROUTING	1,715	BAG	$6.00	MEANS/SITE/033-114-0240	10,290
11) BENTONITE, FOR GROUTING	56	BAG	$9.50	MEANS/SITE/071-301-0300	532
12) GRAVEL, PACKING AT WELL SCREENS	[illegible]	CYD	[illegible]	MEANS/SITE/033-102-[illegible]	[illegible]
13) WOOD CORE BOXES, [illegible] LF/BOX), FOB-SITE	125	EA	[illegible]	ASSUMED	[illegible]
14) PROFESSIONALS - ON SITE					
(A) GEOLOGIST	700	HOUR	$70.00	ESTIMATED	49,000
(B) ENGINEER - CONST. INSPECTION	100	HOUR	$70.00	ESTIMATED	7,000
(INCLUDES: WAGE, SUBSISTENCE, TRAVEL)	-				
15) PUMPS, CENTRIFUGAL 10-BHP					
105-GPM AT 155-FT. HEAD	3	EA	[illegible]	VENDER QUOTE	
16) PUMP INSTALLATION AND FOB-SITE	3	EA	[illegible]	VENDER QUOTE	[illegible]
17) PIPE, MANIFOLD [illegible]" DIA. PVC SOLID	3,000	LF	$8.69	MEANS,CONS/151-551-1930	[illegible],070

ORIGINAL (Red)

18)PIPE MAIN LINE [illegible] DIA. PVC SOLID	[illegible]	LF	$[illegible]	MEANS [illegible] 151-551-1940	[illegible]
19) PIPE, SERVICE LINE [illegible]"DIA.PVC	[illegible]	LF	$[illegible]	MEANS [illegible] 151-551-[illegible]	[illegible]
20)TRENCHING, ALL WATER PIPING SLOPE 0:1, 2-FT.WIDE, 6-FT.DEEP	7,400	LF	$4.17	MEANS/SITE/12.3-110-1340	30,858
21)BEDDING, ALL WATER PIPING SLOPE 0:1, 2-FT.WIDE	7,400	LF	$1.23	MEANS/SITE/12.3-310-1500	9,1[illegible]
22)PLUMBING FIXTURES AND RELATED					
(A) FITLESS ADAPTERS,2"DIA.BRASS	10	EA	$120.00	VENDER QUOTE	1,200
(B) GLOBE VALVE, STEEL,1.5"DIA	10	EA	$134.70	MEANS/MECH/151-980-6770	1,347
(C) COUPLINGS, PVC,1.5"DIA.	300	EA	$12.88	MEANS/MECH/151-558-1120	3,864
(D) 90-ELBOW,1.5"DIA.,PVC	100	EA	$16.00	MEANS/MECH/151-558-0590	1,600
(E) COUPLINGS,PVC,3"DIA.	350	EA	$17.76	MEANS/MECH/151-558-1140	6,216
(F) COUPLINGS,PVC,4"DIA.	300	EA	$23.10	MEANS/MECH/151-558-1160	6,930
(G) 90-DEG. ELBOWS 4"DIA.	30	EA	$32.80	MEANS/MECH/151-558-0610	984
(H) 45-DEG. ELBOWS 4"DIA.	20	EA	$34.85	MEANS/MECH/151-558-0740	697
(I) TEE-3"DIA. PVC SCH.40	[illegible]	EA	$40.05	MEANS/MECH/151-558-0870	45[illegible]
(J) TEE-4"DIA. PVC SCH.40	5	EA	$53.[illegible]	MEANS/MECH/151-558-08[illegible]	[illegible]
(K) GLOBE VALVE,STEEL 4" DIA.	10	EA	$[illegible]	MEANS/MECH/151-980-[illegible]	[illegible]
(L) GLOBE VALVES,STEEL 3"DIA	4	EA	$[illegible]	MEANS/MECH/151-980-[illegible]	4,504
(M) CHECK VALVES, [illegible] DIA BRONZE	[illegible]	EA	$[illegible]	MEANS/MECH 151-980-[illegible]	[illegible]
(N) EXTENDED PIPE [illegible]	[illegible]	EA	$[illegible]	[illegible]	[illegible]
(O) CHECK VALVES, 4" DIA. BRONZE	[illegible]	EA	$[illegible]	MEANS/MECH/151-980-[illegible]	[illegible]
(P) 45-DEG. ELBOWS 3"DIA.	[illegible]	EA	$[illegible]	MEANS/MECH 151-558-[illegible]	[illegible]
23) [illegible]	[illegible]	EA	$[illegible]	[illegible]	[illegible]
24)ELECTRICAL SYSTEMS AND EQUIPMENT					
(C) M.C.C. - SIZE 2, 18"HIGH	1	EA	$769.00	MEANS/ELEC/163-110-0200	769
(D) PILOT LIGHTS, FOR M.C.C.	2	EA	$81.80	MEANS/ELEC/163-110-1700	164
(E) PUSH BUTTONS, FOR M.C.C.	2	EA	$58.80	MEANS/ELEC/163-110-1800	118
(F) MOTOR FEEDER	100	LF	$7.[illegible]	MEANS/ELEC/89.1-310-[illegible]	751
(G) 3-NO.[illegible] WIRE	30	CLF	$49.99	MEANS/ELEC/161-165-0[illegible]	1,500
(H) 3-NO.[illegible] WIRE	36	CLF	$27.28	MEANS/ELEC 161-165-0040	982
(I) ELECTRIC SERVICE	1	EA	$770.00	MEANS/ELEC/89.1-[illegible]	770
(J) CONDUIT - 1" PVC	3,000	LF	$2.35	MEANS/ELEC/160-205-9120	7,050
(K) CONDUIT - [illegible] PVC	3,600	LF	$1.97	MEANS/ELEC/160-205-9110	7,092
(L) HAND HOLES-FOR WIRE PULLING	30	EA	$469.00	MEANS/ELEC/167-110-0600	14,070
(M) UTILITY TRENCHING/BACKFILL	6,600	LF	$2.24	MEANS/SITE/12.3-110-1320	14,784
(N) CONCRETE - CONDUIT BEDDING	95[illegible]	CYD	$45.70	MEANS/SITE/033-122-00[illegible]	43,415
(O) PUMP CONTROLLERS	2	EA	$500.00	ASSUMED	1,000
(P) PUMP MOTOR INSTALLATION	2	EA	$250.00	VENDER QUOTE	[illegible]
(Q) PRESSURE SENSORS- 2/WELL	[illegible]	EA	$434.00	MEANS/MECH 157-420-[illegible]	[illegible]
(R) ELEC. MOTOR ACTUATED VALVE 1-1/2" DIA. 1/WELL	10	EA	$126.00	MEANS MECH/157-420-[illegible]	1,260
(S) RELAYS -SENSORS TO E.M.VALVES	10	EA	$82.00	MEANS/MECH/157-420-3460	820
(T) NO. 12 COPPER WIRE - THW	82	CLF	$22.87	MEANS/ELEC/161-165-0100	1,875
(U) WEATHER-PROOF ENCLOSURES					

ORIGINAL (Red)

AR301148

[illegible] WELLS-CONTROLLER PROTECT	12	[illegible]	[illegible]	ASSUMED	[illegible]
[illegible] PACKER TESTS- [illegible] WELLS-WELL (INCLUDES:LABOR,EQUIP.,MATL)	40	HOUR	$200.00	VENDER QUOTE	8,000
26)WELL DEVELOPMENT- 3 HR/WELL (INCLUDES:LABOR,EQUIP.,MATL)	30	HOUR	$175.00	VENDER QUOTE	5,250
27)PUMP TESTS- 4 WELLS,72-HR.EACH (INCLUDES:LABOR,EQUIP.,MATL)	450	HOUR	$150.00	VENDER QUOTE	67,500
28)ANALYTICS - PACKER TEST SAMPLES 1 SAMPLE PACKER TEST, TCA/DCE 3 SAMPLES PER WELL	25	TESTS	$150.00	ASSUMED	3,750
29)WELL CONSTRUCTION (INCLUDES:LABOR/EQUIP. ONLY) 1-CREW 2-DAY/WELL INC'D ELEC.	24	CREW-DAYS	$450.00	MEANS/SITE/CREW B-43,55, 61(SELECT COMPONENTS)	10,800
30)GEOPHYSICAL SITE INVESTIGATION	1	EA	$25,000.00	ASSUMED	25,000
31)LONG-TERM PUMP TESTS 1 TEST AT [illegible]-HOURS	336	HR	[illegible]	ASSUMED	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] ENGINEERING STUDY OF INDUCED ROCK FRACTURING AT WELLS	1	EA	$15,000.00	ASSUMED	15,000
A) SUB-TOTAL (A)					[illegible]
B) SUBCONTRACTORS WORK ESTIMATED AT 20% OF SUB-TOTAL					141,816
C) FEE AT [illegible] OF SUBCON. WORK					[illegible]
D) SUB-TOTAL [illegible] (A) + FEE					[illegible]
E) CITY INDEX COST ADJUSTMENT AT [illegible] AVERAGE FOR READING, PENNSYLVANIA APPLIED TO SUB-TOTAL (B)				BASED ON MEANS/SITE/CITY COST INDEX,APPENDIX(1988)	686,374
F) TOTAL ADJUSTED DIRECT COSTS (TADC)					
G) INDIRECT CONTRACTOR COSTS					

ORIGINAL (Red)

ORIGINAL (Red)

BERKS SAND PIT INJECTION WELL SYSTEM CAPITAL COST PAGE 4 REV. 14-OCT-8[illegible]

AT [illegible] OF TADC				BASED ON BERKS SITE APPX.	[illegible]
+ CONTRACTOR PROFIT AT [illegible]% OF TADC + INDIRECT					[illegible],000
I) TOTAL FIELD COST (TFC)					1,019,265
J) HEALTH AND SAFETY COST ALLOWANCE AT 5% OF TFC					50,963
K) CONTINGENCY COST AT 20% OF TFC					203,853
L) ENGINEERING COST AT 10% OF TFC					101,927
M) TOTAL CAPITAL COST TFC + H&S + CONT + ENG					$1,376,008

ORIGINAL (Red)

REV. 14-OCT-88 PAGE 1

I ITEM: INJECTION WELL SYSTEM OPNMSC.WK1

BERMI DEAD PIT ANNUAL OPERATION COSTS

NO.	ITEM DESCRIPTION	ANNUAL QUANTITY	UNITS	UNIT COST	ANNUAL COST
1)	OPERATING LABOR				
	(A) TECHNICIAN	520	HR	$25.00	$13,000
	(B) GEOLOGIST	80	HR	$70.00	$5,600
	(C) MANAGER	8	HR	$75.00	$600
2)	MAINTENANCE MATERIALS				
	(A) PUMP REPLACEMENT AT 5-YR. SERVICE LIFE	1	EA	$[illegible]	$[illegible]
	(B) PIPING, VALVES, ETC.	[illegible]	LF	$[illegible]	$[illegible]
	(C) PUMP MAINTENANCE	2	EA	$[illegible]	$[illegible]
3	MAINTENANCE LABOR				
	(A) PUMP REPLACEMENT	1	EA	$[illegible]	$[illegible]
	(B) PUMP MAINTENANCE	32	HR	$50.00	$1,600
	(C)				
4	SUPPLIERS MATERIALS/LABOR				
	(A)				
	(B)				
	(C)				
5)	PURCHASED SERVICES				
	(A) ELECTRICAL POWER	125,648	KW-HR	$0.07	$9,075

AR301151

ORIGINAL (Red)

REV. 14-Oct-88

PAGE 1

6) DISPOSAL				
(A)				
(B)				
7) ADMINISTRATION				
(A)				
(B)				
8) INSURANCE,TAXES,LICENSES				
(A)				
(B)				
(C)				
9) OTHER COSTS				
(A)				
(B)				
A. SUBTOTAL (A)				$37,873
B. CONTINGENCY COST AT 20% OF SUBTOTAL(A)				$7,575
C) SALVAGE AND DECOMMISSION: AT 100% CAPITAL COSTS INCURRED AT 30-TH YEAR, INTEREST = 10% ANNUAL SINKING PAYMENT	$1,380,563			$6,373

AR301152

D [illegible] CAPITAL COST				$[illegible]
E) PRESENT WORTH AT 10% INTEREST AT 30 YEARS				$567,554

AIR STRIPPING TREATMENT SYSTEM

Baker Engineers

S.O. No. 15438-17-5 BAT (ORIGINAL IRON)

Subject: BERKS SAND PIT FS

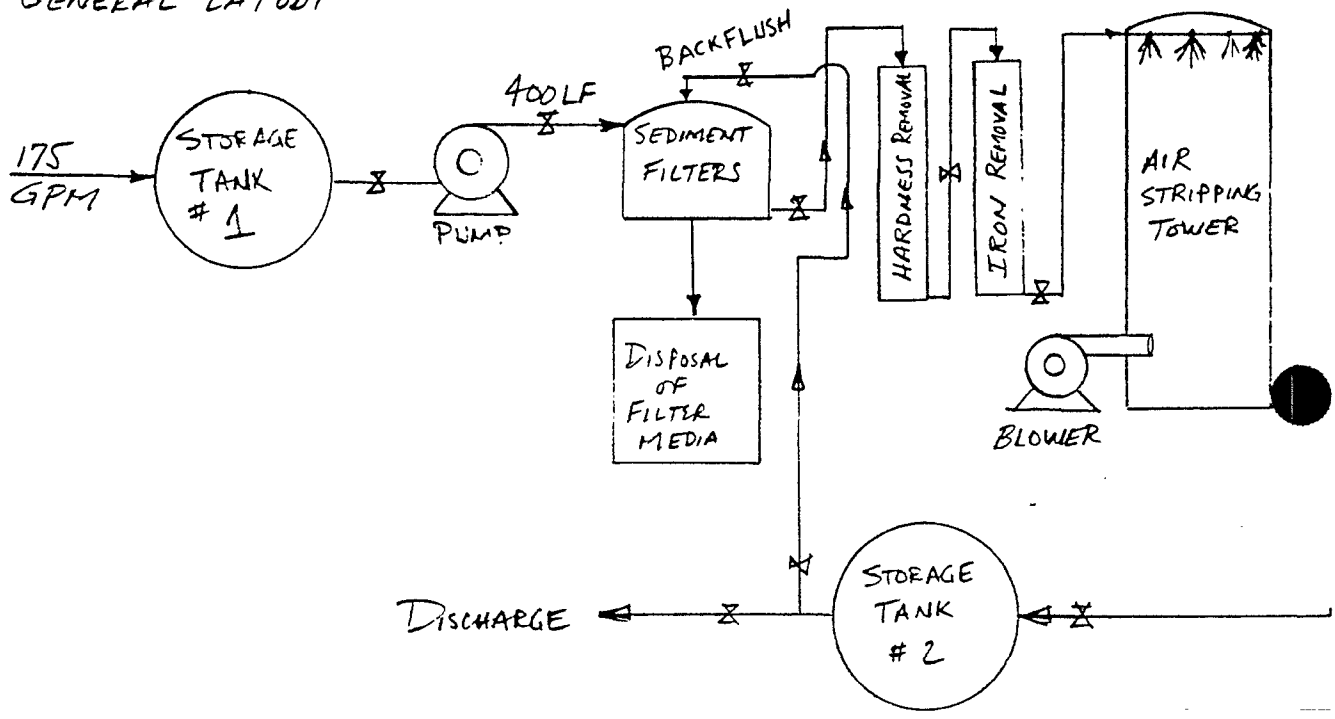
REVISION #1 Sheet No. 1 of 2

AIR STRIPPING TRMT Drawing No.

Computed by LJS Checked By RPA Date 10/19/88

THESE CALCULATIONS MODIFY THE 6/22/88 DESIGN TO REFLECT CHANGES NOTED IN THE REVISION #1 FS CALCULATIONS OF 10/19/88 FOR THE GAC TRMT. TECHNOLOGY.

(1) GENERAL LAYOUT



(2) FILTRATION UNITS

$$Q = 175\ GPM = \frac{10,500\ GPH}{3,480\ GPH/UNIT} \equiv 3\ UNITS$$

MEANS/MECH/152-184-8960 $4,525 EA.

(3) STORAGE TANKS 1 & 2

— USE 100,000 GALLONS EACH AS SHOWN IN 10/19/88 GAC CALCULATIONS.

Baker Engineers

S.O. No. 15438-17-SRI

Subject: BERKS SAND PIT FS
REVISION # 1
AIR STRIPPING TRMT.

Sheet No. 2 of 2
Drawing No.
Computed by LJS Checked By RPM Date 10/19/88

(4) SIMILAR SIZES & QUANTITIES AS 10/19/88 GAC DESIGN FOR:

- PIPES & FITTINGS;
- PUMP;
- ELECTRICAL W/ MODIFICATIONS SHOWN IN 6/23/88 AIR STRIP FS CALCULATIONS;
- BUILDING;
- FENCING; AND,
- WATER SOFTENING UNITS.

(5) AIR STRIP TOWER

— BASIC TOWER SAME AS GIVEN IN 6/22/88 AIR STRIP DESIGN CALCULATIONS.

Baker Engineers

S.O. No. 15438-17-SRI

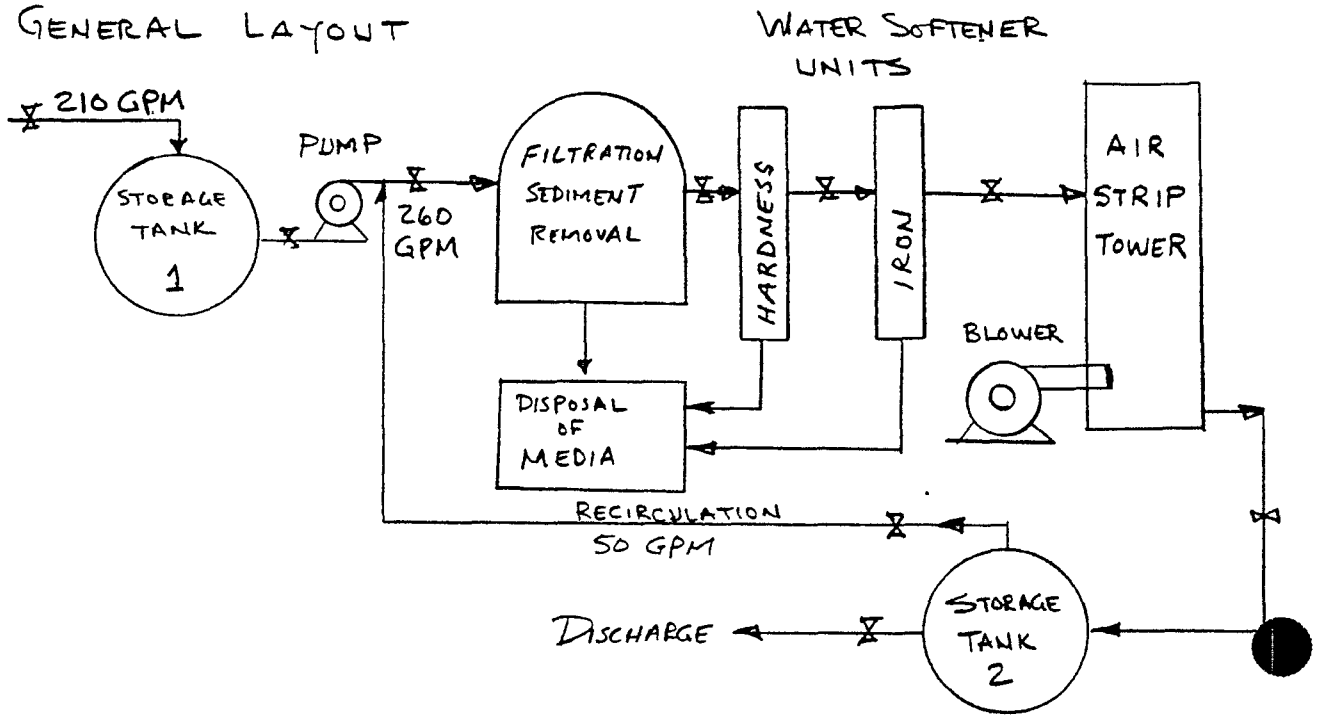
Subject: BERKS SAND PIT
AIR STRIPPER TRMT
FS - DESIGN

Sheet No. 1 of 3

Drawing No.

Computed by LJS Checked By KAK Date 6/22/88

(1) GENERAL LAYOUT



(2) AIR STRIP TOWER - VENDER QUOTE (CALGON)

4' ϕ
30' HIGH
SKID MOUNTED

3" CASCADE MINI-RINGS PACKING
$60,000 INCLUDING BLOWER (ASSUME 10 H.P.)
INSTALLATION EXTRA
→ SAY $8,000

(3) WATER SOFTENER UNITS - VENDER QUOTE

WATER SOFTENER $40,000 EQUIPMENT
1000# SALT/RECHARGE 12,000 INSTALLATION
EQUIPMENT LIFETIME 20-25 YEARS
REMOVAL OF IRON AND HARDNESS BOTH

SIZE
7' HIGH
10' WIDE
12' LONG

IWT - ILLINOIS WATER TRMT CO.
(815) 877-3041

ASSUME RECHARGE 12x/YEAR

AR301157

Baker Engineers

S.O. No. 15438-17-SRI

Subject: BERKS SAND PIT
AIR STRIPPER TRMT.
FS - DESIGN

Sheet No. 2 of 3 (ORIGINAL)

Drawing No.

Computed by LJS Checked By RAK Date 6/23/88

(4) FILTRATION UNITS

Q = 260 GPM = 15,600 GPH

USE 5 UNITS AT 3,480 GPH EACH

MEANS/MECH/152-184-8960 $4,525 EACH

(5) STORAGE TANK #1 & #2

REFER TO G.A.C. TREATMENT SYSTEM DESIGN
FOR MORE DETAILED DESIGN INFO

(2) 250,000 GAL EACH $95,000 TANK

(2) FOUNDATION 250 CYD @ $148.30/CYD
MEANS/SITE/132-051-1000
MEANS/SITE/033-130-4050

(6) PUMP SIZING

REFER TO G.A.C. TRMT. SYSTEM DESIGN
FOR DETAILED DESIGN INFO & VENDER QUOTE

$1,535 / PUMP

(7) PIPING REQUIREMENTS

ASSUME SIMILAR TO G.A.C. TRMT DESIGN

Φ	L
6"	265'
4"	120'
3"	135'

AR301158

Baker Engineers

S.O. No. 15438-17-SRI

Subject: BERKS SAND PIT
AIR STRIPPER TRMT Sheet No. 3 of 3
FS - DESIGN Drawing No.
Computed by LJS Checked By Date 6/23/88

(8) FITTINGS

ASSUME SIMILAR TO G.A.C. TRMT. SYSTEM
REFER TO G.A.C. TRMT SYSTEM DESIGN

(9) ELECTRICAL SYSTEM

SAME AS G.A.C. TRMT. SYSTEM; EXCEPT
ADD BLOWER TO M.C.C.

ASSUME 10 HP BLOWER MOTOR

- MCC 25 H.P SIZE 2, 18" HIGH
  MEANS/ELEC/163-110-0200 $769 @
- STARTER MAGNETIC SIZE 3 TO 25 HP 3φ 200V
  MEANS/ELEC/B9.2-730-0760 $790 @
- MOTOR FEEDER 3φ 15 HP 230V
  MEANS/ELEC/B9.2-720-0600 $6.28/LF
  ASSUME 100 LF SINCE BLOWER WILL BE OUTSIDE BUILDING

(10) PRE-ENGINEERED BUILDING

ASSUME SAME SIZE & PROVISIONS AS FOR G.A.C. TRMT. SYSTEM SINCE WATER SOFTENING UNITS ARE SIMILAR IN SIZE TO GAC UNITS IN AREA. COST $67,278

(11) FENCE: 6' HIGH 3 STRAND BARB WIRE
SAY 300 LF @ $8.57/LF MEANS/CONS/028-308-0200
1 EA - $157 MEANS/CONS/028-350-1460

Baker Engineers

S.O. No. 15438-17-51 ORIGINAL

Subject: Berks Sand Pit Site
AIR STRIP TRMT
FS - DESIGN

Sheet No. 1 of 1

Drawing No.

Computed by RAK Checked By [illegible] Date 6/23/88

Pressure Drop across Air Stripper / Blower Sizing

$L = 13.25$ Kg/s/m² = Liquid Mass Rate

$G = 0.8563$ Kg/s/m² = Gas Mass Rate

$\rho_L = 1000$ kg/m³ = Liquid Density

$\rho_G = 1.293$ Kg/m³ = Gas Density

$F_p = 75\ m^{-1}$ = Packing Factor

$\Psi = 1$ = Ratio of Density of Liquid to Density of H_2O

$\mu_l = 0.94$ cP = Viscosity of Liquid

$g = 9.81$ m/s² = Gravitation Constant

$$\frac{G^2 F_p \Psi \mu^{0.2}}{\rho_g \rho_l g} = 0.0043$$

$$\frac{L}{G}\left(\frac{\rho_g}{\rho_L}\right)^{1/2} = 0.45$$

Pressure Drop = 0.72 in H_2O / ft Packing

$= 0.72 \times 30$ ft $= 21.6$ in H_2O

$\dot{V}_G = 1400$ cfm

Baker Engineers

(ORIGINAL (illegible))

– AIR STRIPPING TREAT –
DESIGN FILE

TELECOPY

TO: Mr. Pat Wilson

FIRM: Mobile Water Technology

TELEPHONE: FAX NO. 901-743-2361

****

FROM: Mr. Tom Stahl

This telecopy consists of 4 pages, including this cover sheet.

DATE: 6-24-88

BAKER/TSA, INC. TELECOPY NO.: 412/269-6097

Baker/TSA, Inc.
Airport Office Park - Bldg. 3
420 Rouser Road
Coraopolis, PA 15108
(412) 269-6000

TELECOPY/FAX MESSAGE

IMPORTANT: IF YOU DO NOT RECEIVE ALL PAGES, PLEASE CALL US BACK AS SOON AS POSSIBLE.

NUMBER OF PAGES INCLUDING COVER PAGE	DATE TRANSMITTED	TIME TRANSMITTED	SUBJECT
3	6/23/88	3:15 pm	Application Questionnaire

FOR: TELECOPY/FAX NUMBER 412/269-6097

NAME	Mr. Tom Stahl
COMPANY	Baker Engineering
ADDRESS	Pittsburgh, PA
CITY/STATE/ZIP	
TELEPHONE NUMBER	

FROM: TELECOPY/FAX NUMBER 901/743-2361

NAME	Mr. Pat Wilson
COMPANY	MOBILE WATER TECHNOLOGY
ADDRESS	2070 AIRWAYS BLVD., P.O. BOX 14867
CITY/STATE/ZIP	MEMPHIS, TN 38114
TELEPHONE NUMBER	901/744-1142
WATS	800/238-3028

— PRELIMINARY DESIGN ONLY —

SPECIAL INSTRUCTIONS: NEED WATER SOFTENER SYSTEM TO REMOVE IRON & HARDNESS ; NEED BALLPARK CAPITAL COSTS (SET-UP INCLUDED) AND GENERAL O&M COSTS PER YEAR.

FOB SITE → READING, PENNSYLVANIA (EAST OF PHILADELPHIA, PA)

ORIGINAL (Red)

APPLICATION QUESTIONNAIRE

DATE:

PREPARED FOR: BAKER / TSA INC (Company)

ADDRESS: 420 ROUSER ROAD (City) CORAOPOLIS (State) PA (Zip Code) 15108

PREPARED BY: LARRY STEARNS (Name) GEOTECH ENG. (Title) (412) 269-6064 (Phone No.)

WATER REQUIREMENTS

		Continuous		Intermittent	
(a)		(Continuous)			
(b)	Maximum Flow:	350 gpm	24		Hour/Day
(c)	Minimum Flow:	250 gpm	24		Hour/Day
(d)	Average Flow:	250 gpm	24		Hour/Day
(e)	Total Gallons Per Day (24 Hours)	360,000			

INTENDED USE

PRE-TREATMENT PRIOR TO AIR STRIPPING TOWER, FOR VOLATILE ORGANICS REMOVAL FROM GROUNDWATER. WANT TO PRE-TREAT FOR IRON AND HARDNESS.

PRODUCT WATER QUALITY

TDS: LOW (~10) (ppm) OXYGEN CONTENT: (GROUNDWATER) ppb

CONDUCTIVITY: LOW (ohms/cm) TURBIDITY: LOW NTU

pH: 7

Allowable Silica Leakage: NA ppm as SiO_2

Special Requirements: REDUCE THE CALCIUM & IRON

WATER SUPPLY:

(a) SOURCE: Municipal or Private - Surface or (Well) or Both (circle appropriate)

(b) COMPOSITION: (Iron) Chlorine, Turbidity, CO_2 and pH must be determined on-site)

Cations (ppm as ion)		Anions (ppm as ion)	
(Calcium) (Ca)	MEDIUM	Hydroxl (OH)	
(Magnesium) (Mg)	MEDIUM	Carbonate (CO_3)	
Sodium (Na)		Bicarbonate (HCO_3)	
Potassium (K)		Sulphate (SO_4)	
(TDS)	LOW	Chloride (Cl)	
Other		Nitrate (NO_3)	
(Iron) (Fe)	FAIRLY HIGH	Fluoride (F)	
Chlorine (Cl_2)		Silica (SiO_2)	
Organics:		(Appearance)	CLEAR
(Turbidity):	LOW NTU	pH:	
SDI:		CO_2:	

ORIGINAL (Red)

(c) WATER TEMPERATURE: ~50°F GROUNDWATER
Maximum:_____(°F) Duration:_____(months)
Minimum:_____(°F) Duration:_____(months)

(d) SUPPLY LINE SIZE: 6"ϕ PVC (inches)

(e) PRESSURE:
Maximum: 25 (psig) Minimum: 20 (psig)

(f) OTHER REMARKS ON SUPPLY WATER: CONTAMINATED WITH VOLATILE ORGANICS

FACILITIES:

(a) ELECTRICAL:
Electrical Power: 230 (volts) _____(amps)
3ϕ (phase) _____(Hz)

(b) DISPOSAL: RCRC TDS FACILITY
Cost:_____ Max TDS Conc:_____(ppm)
pH Restrictions:_____ Drain Size:_____(inches)
Drain Capacity:_____(gpm) Material:_____

(c) SPACE REQUIREMENTS:
Available Floor Area: AS NEEDED! (ft) x _____(ft)
Available Height:_____ Indoor or Outdoor
Entrance Size Limitations: NONE

NOTE: Please include sketch of probable plant layout, including utility hookups, over-all dimensions, etc.

(d) EXISTING EQUIPMENT: DIATOMACEOUS EARTH FILTRATION UP-STREAM
Water Treatment Facility (filtration, etc.)?_____(yes or no)
Description (filtration, softening, pH control, etc.):_____

Is system to be operated in conjunction with any other automatic equipment? YES. If so, describe in detail the nature of the interconnections including a functional description. Operating and specification manuals will be helpful when specifying the equipment required for a proper interface.
WATER SOFTENER DIRECTLY TO AIR STRIP TOWER

Water Storage Available? YES (yes or no)
Storage Capacity: 250,000 GALLONS
Description, materials of construction, etc.
STEEL ABOVE GROUND TANK

(e) ENVIRONMENT:
Temperature Range: _____(°F) Wind:_____
Dirt:_____ Oil Vapors:_____
Corrosive Vapors:_____ Flooding Problems: _
Fire/Explosion Hazards:_____ _
Sun and/or Radiation Shielding:_____ _

→ EQUIPMENT TO BE PLACED INSIDE A [illegible] BUILDING.
BUILDING WILL BE DESIGN AS NEEDED.

Baker Engineers

S.O. No. 15433-[illegible] ORIGINAL

Subject: [illegible]
AIR STRIPPING TEMT
FS-O&M COSTS

Sheet No. 1 of 4

Drawing No.

Computed by TRS Checked By LJS Date 6/24/83

Revised DATE: 6/24/83

① OPERATING LABOR

ASSUME 2 MAN-DAY WEEK × 52 WK/YR = ~~416~~ 832 HR/YR

@ $25/HR CHECK UNITS, METERS, DOMES, FEES, ETC.

COST = ~~416~~ 832 HR × ~~$25~~/HR = ~~$20,800~~ $41,600
500

② TREATMENT CHEMICALS

- WATER SOFTENER UNIT - NEED 1000# SALT FOR RECHARGE FOR EVERY MONTH (12 RECHARGES/YR)
- REMOVE BRINE IN DRUMS

COST → SALT - $8.25/BAG × 20 BAGS × 12 Recharges = 1980/YR

③ PAINTING AIR STRIPPING TOWER

PAINT (1/15 YRS) NO → PAINT EACH 5-YEARS

AREA = 2π (4' × 30') + π/4 (4')² = 407 S.F.

NEED 2 GAL PAINT

2 DAYS TO PRIME, SANDBLAST & PAINT

MEANS SITE CREW: E-9 $785.00/DAY × 2 DAYS = $1518

PRIMER: $16/GAL × 2 GAL = $32

PAINT: $20/GAL × 2 GAL = $40

$1518 CREW
+ 72 PAINT
+ 1000 MOB/DEMOB ETC.
≈ $3,000

$3,000 / 5 = $600/YR

COST/YR = ~~$320~~

④ PAINT PRE-ENGINEERED BLDG

SEE G.A.C.

210/YR ← COST

AR301165

Baker Engineers

S.O. No. 15433-17

Subject: BEFORE SAND FILT
AIR STRIPPER TRMT
FS - O+M COSTS

Sheet No. 2 of 4

Drawing No.

Computed by TES Checked By LTS Date 2-13-88

REVISION DATE: 6/21/88

(5) PAINT STORAGE TANK #1 & #2 — 330/YR ← COST
PAINT 1/5 YRS
SEE GAC

(6) PUMP REPLACEMENT - ~~500~~ 193/YR ← COST
SEE GAC

(7) PUMP MAINTENANCE — $600/YR ← COST
SEE GAC

(8) PIPE REPAIR - FITTINGS — 592/YR
SEE GAC

NO (9) ELECTRICAL SERVICE — ~~$5000/YR~~ ← COST
SEE GAC

(10) SAMPLES - 1 WK
$150 × ~~52~~ 26 SAMPLES = ~~7800~~ 3900/YR ← COST
PRE START LAB - 5000 - ONCE

A CHECK
ELECTRICAL POWER

(a) PUMPS: 65,500 KW-HR/YEAR (SEE G.A.C. TRMT CALC's)

(b) BLOWER (10 HP × .7457)/.85 eff. = 8.77 KW × 24 hr/DAY × 365 DAY/YR
Blower = 76,850 KW-HR/YR

(c) BUILDING LIGHTS: ASSUME $\frac{100 \text{ WATTS}}{1000} \times 20 \text{ LIGHTS} = 2 \text{ KW}$

ASSUME LIGHTS ON 832 hr/YR (operator time)

2 KW × 832 hr = 1,664 KW-HR/YR. TO AR304500
AR301162

Baker Engineers

S.O. No. 15438-17-3 ORIGINAL TYPED

Subject: BERLS SAND PIT
AIR STRIPPING TRMT
FS-D&M COSTS

Sheet No. 3 of 4

Drawing No.

Computed by TRS Checked By LJS Date 6-27-88

REVISION DATE: 6/21/88

(11) DISPOSAL OF BRINE FROM WATER SOFTENER

a) DRUM PRICE = $25 ea FOB

b.) INCINERATE DRUMS = $300/DRUM

c) TRANSPORT

250 MILES TO INCINERATOR @ 3.50/MILE

$\frac{250 \times 3.50}{5} = \$175/\text{DRUM}$

NO (5) → (SEE BELOW)

d. DRUM HANDLING

ASSUME 1 DAY FOR 5 DRUMS

MEANS 1988 SITE CREW E-10 A

$550 DAY × 1 DAY = $\frac{550}{5}$ = 110/DRUM

UNIT DISPOSAL COST = $1110/DRUM × 5 DRUMS = ~~$5,550~~ ← COST

NO (5) (see below)

CHECK

SALT 48 lb/CFT UNIT WT.

$1000\#/48 = \underset{\text{REGENERATION}}{20.83 \text{ CFT}} \times 12 = 250 \text{ CFT/YR}$.

DRUM 7 CFT/DRUM

250/7 ≡ 36 DRUMS/YEAR (CAN 40)

@ $1,000/DRUM TO INCINERATE, TEST, HANDLE, TRANSPORT, ETC

$1000 × ~~40~~ 7 = $40,000/YR

10

Baker Engineers

S.O. No. 15438-17-055

Subject: BEAL SAND PIT
AIR STRIPPING TRMT
FS - O & M COSTS

Sheet No. 4 of 7

Drawing No.

Computed by TRS Checked By LJS Date 6/24/88

DATE REVISION: 6/29/88

(12) FILTRATION UNITS

see GAC - ASSUMED

MAINTENANCE COST @ (20 Bed charges × $200/Bed charge) = 4000/YR

DISPOSAL COST (2 DRUMS/Bed charges × 20 Bed Changes × $1000/DRUM)
= ~~$40,000~~ 10,000 /YR - INCINERATOR

Change to 10 DRUMS/YR

AR301168

Baker Engineers

S.O. No. 1543-8-17-C (ORIGINAL)

Subject: Vapor Phase Carbon Adsorption
Total Capital Cost
Banks Sand Pit

Sheet No. 1 of 4

Drawing No.

Computed by RPA Checked By RAK Date 11/24/88

ITEM	DESCRIPTION	COST
A.	Subtotal (A) Total Capital Cost	133,800.
B.	Subcontractors Work at 20% of (A)	26,760. ✓
C.	Fee at 10% of B.	2,676. ✓
D.	Subtotal (B): (A) + Fee	136,476. ✓
E.	City Index Cost Adjustment at 0.949 Average Applied to (B)	129,516. ✓
F.	Total Adjusted Direct Cost (TADC):	129,516.
G.	Indirect Contractor Cost at 35% TADC	45,331.
H.	Contractor Profit at 10% of (TADC + Indirect)	17,485. ✓
I.	Total Field Cost TFC = F+G+H	192,332. ✓
J.	Health and Safety at 5% TFC	9,617.
K	Contingency at 20% TFC	38,466.
L.	Engineering at 10% TFC	19,233.
M.	Total Capital Cost TEC = I+J+K+L	259,648

AR301169

ORIGINAL

Baker Engineers

S.O. No. 15438-17-SR (Rev)

Subject: Berks Sand Pit
Vapor Phase Carbon Adsorption

Sheet No. 2 of 4

Drawing No.

Computed by RPA Checked By RAK Date 10/24/88

ITEM	DESCRIPTION	COST
A.	Subtotal (A): O&M Cost	265,800.
B.	Contingency cost at 20% of (A)	53,160. ✓
C.	Salvage and Decomissioning at 10% and 30 yr on 100% of TCC	1,584.
D.	Annual O&M Cost = A+B+C	320544.
E.	Present Worth O&M at 10% with 30 yrs	3,021,736

AR301170

Baker Engineers

S.O. No. 15438-17-SF ORIGINAL

Subject: BERKS SAND PIT S TE F1/FS

OPTION: VAPOR-PHASE GAC Sheet No. 3 of 4

COST ESTIMATION SUMMARY Drawing No.

Computed by RAK Checked By MGM Date 10/2 188

CAPITAL COST COMPONENTS	ASSUMED % OF TOTAL	COST	RATIOED % OF TOTAL
PURCHASED EQUIPMENT	30	35,900	27.0
PURCHASED EQUIPMENT INSTALLATION	6	7,200	5.4
INSTRUMENTATION (INSTALLED)	2	2,400	1.8
PIPING (INSTALLED)	8	9,600	7.2
ELECTRICAL (INSTALLED)	5	6,000	4.5
BUILDINGS (INCLUDING SERVICES)	3	3,600	2.7
YARD IMPROVEMENTS	5	6,000	4.5
SERVICE FACILITIES (INSTALLED)	8	9,600	7.2
LAND	N/A	N/A	N/A
ENGINEERING AND SUPERVISION	10	12,000	9.0
CONSTRUCTION EXPENSE	8	9,600	7.2
CONTRACTOR'S FEE	4	5,300	3.5
CONTINGENCY	22.25	26,600	20.0
	111.25 ✓	$133,800 ✓	100.0 ✓

$133,800 IS ITEM A OF SHEET NO. 1

METHOD TAKEN FROM PETERS AND TIMMERHAUS, PLANT DESIGN AND ECONOMICS FOR CHEMICAL ENGINEERS, THIRD EDITION, 1980

AR301171

Baker Engineers

S.O. No. 154 - 17 - [illegible]

Subject: BERKS SAND PIT SITE [illegible]
VAPOR PHASE CARBON ADSORPTION Sheet No. 4 of 4
O&M COST, SUBTOTAL A Drawing No.
Computed by RAK Checked By MGM Date 10/2-88

GRANULATED ACTIVATED CARBON
170,000 lb /yr @ $1.50 /lb = 255,000/yr ✓

NATURAL GAS
660 MM BTU/yr @ $5.00 /MM BTU = 3,300/yr ✓

OPERATOR
200 hr/yr @ $25.00/hr = 5,000/yr ✓

ANALYTICS / QUARTERLY
4/yr @ $500/sample = 2,000/yr

$265,800

AR301172

Baker Engineers

S.O. No. 15438-17-SR

Subject: BERKS SAND PIT SITE RI/FS
OPTION: LIQUID-PHASE GAC Sheet No. 1 of 4
TOTAL CAPITAL COST Drawing No.
Computed by RAK Checked By MGM Date 10/27/88

ITEM	DESCRIPTION	COST
A.	SUBTOTAL (A): TOTAL CAPITAL COST	304,000
B.	SUBCONTRACTORS WORK A 20% X ITEM A	61,800
C.	FEE AT 10% OF ITEM B	6,200
D.	SUBTOTAL (B) = SUBTOTAL (A) + FEE	315,000 ✓
E.	ADJUST FOR LOCATION: 0.949 X SUBTOTAL (B)	299,000 ✓
F.	TOTAL ADJUSTED DIRECT COST (TADC)	299,000
G.	INDIRECT CONTRACTOR COST: 35% X TADC	104,700 ✓
H.	CONTRACTOR PROFIT AT 10% X (F + G)	40,400 ✓
I.	TOTAL FIELD COST: TFC = F + G + H	444,400
J.	HEALTH AND SAFETY AT 5% TFC	22,200
K.	CONTINGENCY AT 20% TFC	88,900
L.	ENGINEERING AT 10% TFC	44,400
M.	TOTAL CAPITAL COST TCC = I + J + K + L	$ 599,600

Baker Engineers

S.O. No. 15438-17 - ORIG.

Subject: BERKS SAND PIT SITE RI/FS

OPTION: LIQUID-PHASE GAC Sheet No. 2 of 4

TOTAL O&M COST Drawing No.

Computed by RAK Checked By MGM Date 10/27/88

ITEM	DESCRIPTION	COST
A	SUBTOTAL (A) O&M COST	$79,000
B	CONTINGENCY COST AT 20% OF (A)	15,800
C	SALVAGE AND DECOMISSIONING AT 10% AND 30 YR AT 100% OF TCC	3,660
D	ANNUAL O&M COST = A+B+C	94,460
E	PRESENT WORTH O&M AT 10% OVER 30 YRS	$890,500

AR301174

ORIGINAL

Baker Engineers

S.O. No. 15438-17-SP

Subject: BERKS SAND PIT SITE R1/FS

OPTION: LIQUID-PHASE GAC Sheet No. 3 of 4

COST ESTIMATION SUMMARY Drawing No.

Computed by RAK Checked By MGM Date 10/24/88

CAPITAL COST COMPONENTS	ASSUMED % OF TOTAL	COST	PAIDED % OF TOTAL
PURCHASED EQUIPMENT	30	85,000	27.5
PURCHASED EQUIPMENT INSTALLATION	6	17,000	5.5
INSTRUMENTATION (INSTALLED)	5	15,110	4.8
PIPING (INSTALLED)	8	22,700	7.3
ELECTRICAL (INSTALLED)	2	5700	1.8
BUILDINGS (INCLUDING SERVICES)	3	8500	2.7
YARD IMPROVEMENTS	5	15,110	4.8
SERVICE FACILITIES (INSTALLED)	.8	22,700	7.3
LAND	N/A	—	—
ENGINEERING AND SUPERVISION	10	28,400	9.2
CONSTRUCTION EXPENSE	6	17,000	5.5
CONTRACTOR'S FEE	4	11,300	3.6
CONTINGENCY	21.98	61,800	20.0
	108.98	309,000	100.01

METHOD TAKEN FROM PETERS AND TIMMERHAUS PLANT DESIGN AND ECONOMICS FOR CHEMICAL ENGINEERS THIRD EDITION, 1980.

AR301175

Baker Engineers

S.O. No. 1543E-17-SF2

Subject: BERKS SAND PIT SITE RIFS

OPTION: LIQUID-PHASE GAC

COST ESTIMATION SUMMARY

Sheet No. 4 of 4

Drawing No.

Computed by RAK Checked By MGM Date 10/27/88

GRANULATED ACTIVATED CARBON

48,000 lb/yr. @ $1.50/lb = 72,000/yr

OPERATOR

200 hr/yr @ $25.00/hr = 5,000 /yr

ANALYTICS/QUARTERLY

4/yr @ $500/sample = 2,000 /yr

$79,000

AR301176

ORIGINAL (Red)

BERKS SAND PIT RI/FS AIR STRIPPING TREATMENT SYSTEM CAPITAL COSTS
SO#15438-17-SRI BERKAIR2.WK1

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	REFERENCE SOURCE	ITEM TOTAL ($)
1) EQUIPMENT MOBILIZATION	1	EA	$10,000.00	ASSUMED	10,000
2) SITE PREPARATION					
CLEAR AND GRUB (LIGHT TREES)	2	ACRES	$1,660.00	MEANS/SITE/021-104-0010	3,320
3) STORAGE TANKS	2	EA	$84,000.00	MEANS/SITE/132-051-1000	168,000
4) FOUNDATION - STORAGE TANKS	75	CYD	$148.30	MEANS/SITE/033-130-4050	11,123
5) SEDIMENT REMOVAL FILTERS	3	EA	$4,525.00	MEANS/MECH/152-184-8960	13,575
6) AIR STRIPPING TOWER	1	SKID	$68,000.00	VENDER QUOTE	68,000
7) PUMP	1	EA	$1,535.00	VENDER QUOTE	1,535
8) (INTENTIONALLY BLANK)					
9) PIPE - 4"DIA. PVC	920	LF	$10.14	MEANS/CONS/151-551-1940	9,329
10)(INTENTIONALLY BLANK)					
11)PLUMBING FIXTURES AND RELATED					
GLOBE VALVE 4"DIA.	19	EA	$1,640.00	MEANS/MECH/151-980-3760	31,160
CHECK VALVE	7	EA	$1,115.00	MEANS/MECH/151-980-1460	7,805
TEE	4	EA	$103.00	MEANS/MECH/151-550-0890	412
COUPLINGS	92	EA	$23.08	MEANS/MECH/151-550-1160	2,123
90-DEG. ELBOWS	35	EA	$37.40	MEANS/MECH/151-550-2190	1,309
12)ELECTRICAL SYSTEM					
(A) M.C.C.-SIZE 2, 25 H.P.	1	EA	$769.00	MEANS/ELEC/163-110-0200	769
(B) STARTER-MAGNETIC 10 H.P.	2	EA	$545.00	MEANS/ELEC/89.2-730-0680	1,090
(C) PILOT LIGHT	2	EA	$94.00	MEANS/ELEC/163-110-1700	188
(D) PUSH BUTTON START	2	EA	$69.00	MEANS/ELEC/163-110-1800	138
(E) MOTOR INSTALLATION PACKAGE	2	EA	$1,320.00	MEANS/ELEC/163-110-0680	2,640
(F) MOTOR FEEDER	400	LF	$4.65	MEANS/ELEC/89.2-720-0360	1,860
(G) PUMP CONTROLLER UNIT	2	EA	$500.00	ASSUMED	1,000

(H) HAND-HOLE BOXES	4	EA	$469.00	MEANS/ELEC/167-110-0600	1,876
(I) UTILITY TRENCH/BACKFILL	400	LF	$2.24	MEANS/SITE/12.3-110-1320	896
(J) CONCRETE CONDUIT BEDDING	15	CYD	$45.70	MEANS/SITE/033-122-0010	686
(K) MOTOR FEEDER	100	LF	$6.28	MEANS/ELEC/B9.2-720-0600	628
(L) BLOWER STARTER-MAG. SIZE 3	1	EA	$790.00	MEANS/ELEC/B9.2-730-0760	790
13)PRE-ENGINEERED BUILDING	1	EA	$67,278.00	(REFER TO DESIGN CALC.'S)	67,278
14)FENCING	300	LF	$8.57	MEANS/CONS/ 028-308-0200	2,571
15)FENCE GATE	1	EA	$152.00	MEANS/CONS/028-308-1400	152
16)PROFESSIONALS - ON SITE					
(A) ENGINEER	100	HOUR	$70.00	ESTIMATED	7,000
(B) HEALTH/SAFETY OFFICER	80	HOUR	$70.00	ESTIMATED	5,600
(C) CONSTRUCTION INSPECTOR	500	HOUR	$60.00	ESTIMATED	30,000
17)TRENCHING, 6"DIA. PIPE SLOPE 0:1, 2-FT.WIDE, 6-FT.DEEP	400	LF	$4.17	MEANS/SITE/12.3-110-1340	1,668
18)BEDDING, 6"DIA. PIPE SLOPE 0:1, 2-FT.WIDE,8"DIA.PIPE	400	LF	$1.17	MEANS/SITE/12.3-310-1460	468
19)DEMOBILIZATION - AT 100% OF MOB.	1	EA	$10,000.00	ASSUMED	10,000
A) SUB-TOTAL (A)					464,988
B) SUBCONTRACTORS WORK ESTIMATED AT 20% OF SUB-TOTAL					92,998
C) FEE AT 10% OF SUBCON. WORK					9,300
D) SUB-TOTAL (B) = (A) + FEE					474,288
E) CITY INDEX COST ADJUSTMENT AT 0.949 AVERAGE FOR READING, PENNSYLVANIA APPLIED TO SUB-TOTAL (B)				BASED ON MEANS/SITE/CITY COST INDEX,APPENDIX(1988)	450,099
F) TOTAL ADJUSTED DIRECT COSTS (TADC)					450,099
G) INDIRECT CONTRACTOR COSTS AT 35% OF TADC				BASED ON MEANS/SITE/APPX.	157,535

H) CONTRACTOR PROFIT AT 10% OF TADC + INDIRECT	60,763
I) TOTAL FIELD COST (TFC)	668,397
J) HEALTH AND SAFETY COST ALLOWANCE AT 5% OF TFC	33,420
K) CONTINGENCY COST AT 20% OF TFC	133,679
L) ENGINEERING COST AT 10% OF TFC	66,840
M) TOTAL CAPITAL COST TFC + H/S + CONT + ENG	$902,336

SYSTEM: AIR TREATMENT OPAIR2.WK1

BERKS SAND PIT ANNUAL OPERATION COSTS

NO.	ITEM DESCRIPTION	ANNUAL QUANTITY	UNITS	UNIT COST	ANNUAL COST
1)	MAINTENANCE LABOR				
	(A) PAINT TANKS/AIR TOWER	1.00	DAY	$400.00	$400
	(B) PUMP AND BLOWER MAINTENANCE	60.00	HR	$25.00	$1,500
	(C) PUMP AND BLOWER REPLACEMENT	0.30	EA	$250.00	$75
	(D) PIPING REPAIRS	1.00	DAY	$591.60	$592
2)	MAINTENANCE MATERIALS				
	(A) PAINTING	0.20	EA	$400.00	$80
	(B) PUMP AND BLOWER REPLACEMENT	0.30	EA	$3,000.00	$900
	(C) PUMP AND BLOWER MAINTENANCE	3.00	EA	$100.00	$300
	(D) PIPING REPAIRS	0.20	EA	$1,000.00	$200
3)	OPERATING LABOR				
	(A) OPERATOR	832.00	HR	$25.00	$20,800
	(B)				
4)	AUXILIARY MATERIALS/LABOR				
	(A) RECHARGE SOFTENERS	240.00	BAGS SALT	$8.25	$1,980
	(B) PAINT BUILDING	0.20	EA	$1,056.00	$211
	(C) REPLACE FILTER MEDIA	12.00	EA	$200.00	$2,400

5) PURCHASED SERVICES				
(A) ELECTRICAL POWER	145,000.00	KW-HR	$0.07	$10,150
(B)				
6) DISPOSAL				
(A) DISPOSE FILTER MEDIA (DRUM INCINERATION)	10.00	DRUMS	$850.00	$8,500
(B) DISPOSE SOFTENER MEDIA (DRUM INCINERATION)	10.00	DRUMS	$850.00	$8,500
7) ADMINISTRATION				
(A) ENGINEERING SERVICES				
PROFESSIONAL	160.00	HR	$45.00	$7,200
MANAGEMENT	40.00	HR	$75.00	$3,000
CLERICAL	40.00	HR	$25.00	$1,000
(B)				
8) INSURANCE,TAXES,LICENSES				
(A) INSURANCE	1.00	EA	$5,000.00	$5,000
(B) TAXES	1.00	EA	$1,000.00	$1,000
(C)				
9) OTHER COSTS				
(A) WEEKLY ANALYTICS	52.00	SAMPLE SETS	$150.00	$7,800
(B)				
(C)				
A) SUBTOTAL (A)				$81,588
B) CONTINGENCY COST				

AT 20% OF SUBTOTAL(A)				$16,318
C) SALVAGE AND DECOMMISSION: AT 100% CAPITAL COSTS INCURRED AT 30-TH YEAR, INTEREST = 10% ANNUAL SINKING PAYMENT	$1,066,729			$6,485
D) ANNUALIZED CAPITAL COST				$104,390
E) PRESENT WORTH AT 10% INTEREST AT 30 YEARS				$984,079

APPENDIX B

APPENDIX B

SENSITIVITY ANALYSIS

RAA NO. 1

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.1

Sensitivity Factor For Capital/O&M Costs: 0.50 SENALT11.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$0	$0	$0
SENSITIVE CAPTIAL COSTS	$0	$0	$0
SENSITIVE CAPITAL COSTS * FACTOR	$0	$0	$0
Subtotal (A)	$0	$0	$0
ADJUSTED SUBCONTRACTORS WORK	$0	$0	$0
SUBCONTRACTOR'S FEE	$0	$0	$0
BARE, DIRECT FIELD COST	$0	$0	$0
ADJUSTED INDIRECT CONTRACTOR COSTS	$0	$0	$0
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$0	$0	$0
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$0	$0	$0
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$0	$0	$0
TOTAL ADJUSTED FIELD COSTS	$0	$0	$0
ADJUSTED HEALTH AND SAFETY COST	$0	$0	$0
ADJUSTED CONTINGENCY COST	$0	$0	$0
ADJUSTED ENGINEERING COST	$0	$0	$0
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$0	$0	$0

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$49,240	$49,240	$49,240
ANNUAL SENSITIVE O&M COSTS	$30,550	$30,550	$30,550
ANNUAL SENSITIVE O&M COSTS * FACTOR	$15,275	$15,275	$15,275
SUBTOTAL (A)	$64,515	$64,515	$64,515
ADJUSTED CONTINGENCY COST	$6,452	$12,903	$19,355
SINKING FUND COST (U/F,TACC,10%,30-yr)	$0	$0	$0
ANNUAL OPERATION/MAINTENANCE COST (O/M)	$70,967	$77,418	$83,870
PRESENT WORTH (10%,30-yr) ON ANNUAL O/M	$668,995	$729,813	$790,631

TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$668,995	$729,813	$790,631
PERCENT RESPONSE TO ADJUSTMENTS	-8.3%	0.0%	8.3%

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.1

Sensitivity Factor For Capital/O&M Costs: 1.00 SENALT12.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$0	$0	$0
SENSITIVE CAPITAL COSTS	$0	$0	$0
SENSITIVE CAPITAL COSTS * FACTOR	$0	$0	$0
Subtotal (A)	$0	$0	$0
ADJUSTED SUBCONTRACTORS WORK	$0	$0	$0
SUBCONTRACTOR'S FEE	$0	$0	$0
BARE, DIRECT FIELD COST	$0	$0	$0
ADJUSTED INDIRECT CONTRACTOR COSTS	$0	$0	$0
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$0	$0	$0
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$0	$0	$0
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$0	$0	$0
TOTAL ADJUSTED FIELD COSTS	$0	$0	$0
ADJUSTED HEALTH AND SAFETY COST	$0	$0	$0
ADJUSTED CONTINGENCY COST	$0	$0	$0
ADJUSTED ENGINEERING COST	$0	$0	$0
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$0	$0	$0

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$49,240	$49,240	$49,240
ANNUAL SENSITIVE O&M COSTS	$30,550	$30,550	$30,550
ANNUAL SENSITIVE O&M COSTS * FACTOR	$30,550	$30,550	$30,550
SUBTOTAL (a)	$79,790	$79,790	$79,790
ADJUSTED CONTINGENCY COST	$7,979	$15,958	$23,937
SINKING FUND COST (U/F,TACC,10%,30-yr)	$0	$0	$0
ANNUAL OPERATION/MAINTENANCE COST (O/M)	$87,769	$95,748	$103,727
PRESENT WORTH (10%,30-yr) ON ANNUAL O/M	$827,391	$902,608	$977,826

TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$827,391	$902,608	$977,826
PERCENT RESPONSE TO ADJUSTMENTS	-8.3%	0.0%	8.3%

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.1

Sensitivity Factor For Capital/O&M Costs: 1.50 SENALT13.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$0	$0	$0
SENSITIVE CAPTIAL COSTS	$0	$0	$0
SENSITIVE CAPITAL COSTS * FACTOR	$0	$0	$0
Subtotal (A)	$0	$0	$0
ADJUSTED SUBCONTRACTORS WORK	$0	$0	$0
SUBCONTRACTOR'S FEE	$0	$0	$0
BARE, DIRECT FIELD COST	$0	$0	$0
ADJUSTED INDIRECT CONTRACTOR COSTS	$0	$0	$0
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$0	$0	$0
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$0	$0	$0
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$0	$0	$0
TOTAL ADJUSTED FIELD COSTS	$0	$0	$0
ADJUSTED HEALTH AND SAFETY COST	$0	$0	$0
ADJUSTED CONTINGENCY COST	$0	$0	$0
ADJUSTED ENGINEERING COST	$0	$0	$0
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$0	$0	$0

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$49,240	$49,240	$49,240
ANNUAL SENSITIVE O&M COSTS	$30,550	$30,550	$30,550
ANNUAL SENSITIVE O&M COSTS * FACTOR	$45,825	$45,825	$45,825
SUBTOTAL (A)	$95,065	$95,065	$95,065
ADJUSTED CONTINGENCY COST	$9,507	$19,013	$28,520
SINKING FUND COST (U/F,TACC,10%,30-yr)	$0	$0	$0
ANNUAL OPERATION/MAINTENANCE COST (O/M)	$104,572	$114,078	$123,585
PRESENT WORTH (10%,30-yr) ON ANNUAL O/M	$985,787	$1,075,404	$1,165,021

TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$985,787	$1,075,404	$1,165,021
PERCENT RESPONSE TO ADJUSTMENTS	-8.3%	0.0%	8.3%

ORIGINAL (Red)

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.1

Sensitivity Factor For Capital/O&M Costs: 2.00 SENALT14.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$0	$0	$0
SENSITIVE CAPTIAL COSTS	$0	$0	$0
SENSITIVE CAPITAL COSTS * FACTOR	$0	$0	$0
Subtotal (A)	$0	$0	$0
ADJUSTED SUBCONTRACTORS WORK	$0	$0	$0
SUBCONTRACTOR'S FEE	$0	$0	$0
BARE, DIRECT FIELD COST	$0	$0	$0
ADJUSTED INDIRECT CONTRACTOR COSTS	$0	$0	$0
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$0	$0	$0
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$0	$0	$0
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$0	$0	$0
TOTAL ADJUSTED FIELD COSTS	$0	$0	$0
ADJUSTED HEALTH AND SAFETY COST	$0	$0	$0
ADJUSTED CONTINGENCY COST	$0	$0	$0
ADJUSTED ENGINEERING COST	$0	$0	$0
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$0	$0	$0

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$49,240	$49,240	$49,240
ANNUAL SENSITIVE O&M COSTS	$30,550	$30,550	$30,550
ANNUAL SENSITIVE O&M COSTS * FACTOR	$61,100	$61,100	$61,100
SUBTOTAL (A)	$110,340	$110,340	$110,340
ADJUSTED CONTINGENCY COST	$11,034	$22,068	$33,102
SINKING FUND COST (U/F,TACC,10%,30-yr)	$0	$0	$0
ANNUAL OPERATION/MAINTENANCE COST (O/M)	$121,374	$132,408	$143,442
PRESENT WORTH (10%,30-yr) ON ANNUAL O/M	$1,144,182	$1,248,199	$1,352,215

TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$1,144,182	$1,248,199	$1,352,215
PERCENT RESPONSE TO ADJUSTMENTS	-8.3%	0.0%	8.3%

ORIGINAL
(Red)

RAA NO. 2

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.2

Sensitivity Factor For Capital/O&M Costs: 0.50 SENALT21.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$216,820	$216,820	$216,820
SENSITIVE CAPTIAL COSTS	$219,050	$219,050	$219,050
SENSITIVE CAPITAL COSTS * FACTOR	$109,525	$109,525	$109,525
Subtotal (A)	$326,345	$326,345	$326,345
ADJUSTED SUBCONTRACTORS WORK	$32,635	$65,269	$97,904
SUBCONTRACTOR'S FEE	$3,263	$6,527	$9,790
BARE, DIRECT FIELD COST	$329,608	$332,872	$336,135
ADJUSTED INDIRECT CONTRACTOR COSTS	$65,922	$116,505	$235,295
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$395,530	$449,377	$571,430
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$375,358	$426,459	$542,287
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$37,536	$42,646	$54,229
TOTAL ADJUSTED FIELD COSTS	$412,894	$469,105	$596,516
ADJUSTED HEALTH AND SAFETY COST	$12,387	$23,455	$59,652
ADJUSTED CONTINGENCY COST	$41,289	$93,821	$178,955
ADJUSTED ENGINEERING COST	$20,645	$46,910	$119,303
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$487,215	$633,291	$954,425

ORIGINAL (Red)

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$73,890	$73,890	$73,890
ANNUAL SENSITIVE O&M COSTS	$49,800	$49,800	$49,800
ANNUAL SENSITIVE O&M COSTS * FACTOR	$24,900	$24,900	$24,900
SUBTOTAL (A)	$98,790	$98,790	$98,790
ADJUSTED CONTINGENCY COST	$9,879	$19,758	$29,637
SINKING FUND COST (U/F,TACC,10%,30-yr)	$2,962	$3,850	$5,802
ANNUAL OPERATION/MAINTENANCE COST (O/M)	$111,631	$122,398	$134,229
PRESENT WORTH (10%,30-yr) ON ANNUAL O/M	$1,052,335	$1,153,836	$1,265,368
TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$1,539,550	$1,787,127	$2,219,793
PERCENT RESPONSE TO ADJUSTMENTS	-13.9%	0.0%	24.2%

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.2

Sensitivity Factor For Capital/O&M Costs: 1.00 SENALT22.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$216,820	$216,820	$216,820
SENSITIVE CAPTIAL COSTS	$219,050	$219,050	$219,050
SENSITIVE CAPITAL COSTS * FACTOR	$219,050	$219,050	$219,050
Subtotal (A)	$435,870	$435,870	$435,870
ADJUSTED SUBCONTRACTORS WORK	$43,587	$87,174	$130,761
SUBCONTRACTOR'S FEE	$4,359	$8,717	$13,076
BARE, DIRECT FIELD COST	$440,229	$444,587	$448,946
ADJUSTED INDIRECT CONTRACTOR COSTS	$88,046	$155,606	$314,262
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$528,274	$600,193	$763,208
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$501,332	$569,583	$724,285
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$50,133	$56,958	$72,428
TOTAL ADJUSTED FIELD COSTS	$551,466	$626,541	$796,713
ADJUSTED HEALTH AND SAFETY COST	$16,544	$31,327	$79,671
ADJUSTED CONTINGENCY COST	$55,147	$125,308	$239,014
ADJUSTED ENGINEERING COST	$27,573	$62,654	$159,343
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$650,730	$845,831	$1,274,741

ORIGINAL (Red)

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$73,890	$73,890	$73,890
ANNUAL SENSITIVE O&M COSTS	$49,800	$49,800	$49,800
ANNUAL SENSITIVE O&M COSTS * FACTOR	$49,800	$49,800	$49,800
SUBTOTAL (A)	$123,690	$123,690	$123,690
ADJUSTED CONTINGENCY COST	$12,369	$24,738	$37,107
SINKING FUND COST (U/F,TACC,10%,30-yr)	$3,956	$5,142	$7,750
ANNUAL OPERATION/MAINTENANCE COST (O/M)	$140,015	$153,570	$168,547
PRESENT WORTH (10%,30-yr) ON ANNUAL O/M	$1,319,910	$1,447,692	$1,588,874

TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$1,970,639	$2,293,523	$2,863,616
PERCENT RESPONSE TO ADJUSTMENTS	-14.1%	0.0%	24.9%

ORIGINAL (Red)

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.2

Sensitivity Factor For Capital/O&M Costs: 1.50 SENALT23.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$216,820	$216,820	$216,820
SENSITIVE CAPTIAL COSTS	$219,050	$219,050	$219,050
SENSITIVE CAPITAL COSTS * FACTOR	$328,575	$328,575	$328,575
Subtotal (A)	$545,395	$545,395	$545,395
ADJUSTED SUBCONTRACTORS WORK	$54,540	$109,079	$163,619
SUBCONTRACTOR'S FEE	$5,454	$10,908	$16,362
BARE, DIRECT FIELD COST	$550,849	$556,303	$561,757
ADJUSTED INDIRECT CONTRACTOR COSTS	$110,170	$194,706	$393,230
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$661,019	$751,009	$954,987
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$627,307	$712,707	$906,282
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$62,731	$71,271	$90,628
TOTAL ADJUSTED FIELD COSTS	$690,037	$783,978	$996,911
ADJUSTED HEALTH AND SAFETY COST	$20,701	$39,199	$99,691
ADJUSTED CONTINGENCY COST	$69,004	$156,796	$299,073
ADJUSTED ENGINEERING COST	$34,502	$78,398	$199,382
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$814,244	$1,058,371	$1,595,057

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$73,890	$73,890	$73,890
ANNUAL SENSITIVE O&M COSTS	$49,800	$49,800	$49,800
ANNUAL SENSITIVE O&M COSTS * FACTOR	$74,700	$74,700	$74,700
SUBTOTAL (A)	$148,590	$148,590	$148,590
ADJUSTED CONTINGENCY COST	$14,859	$29,718	$44,577
SINKING FUND COST (U/F,TACC,10%,30-yr)	$4,950	$6,434	$9,697
ANNUAL OPERATION/MAINTENANCE COST (O/M)	$168,399	$184,742	$202,864
PRESENT WORTH (10%,30-yr) ON ANNUAL O/M	$1,587,484	$1,741,549	$1,912,381

TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$2,401,728	$2,799,920	$3,507,438
PERCENT RESPONSE TO ADJUSTMENTS	-14.2%	0.0%	25.3%

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.2

Sensitivity Factor For Capital/O&M Costs: 2.00 SENALT24.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$216,820	$216,820	$216,820
SENSITIVE CAPTIAL COSTS	$219,050	$219,050	$219,050
SENSITIVE CAPITAL COSTS * FACTOR	$438,100	$438,100	$438,100
Subtotal (A)	$654,920	$654,920	$654,920
ADJUSTED SUBCONTRACTORS WORK	$65,492	$130,984	$196,476
SUBCONTRACTOR'S FEE	$6,549	$13,098	$19,648
BARE, DIRECT FIELD COST	$661,469	$668,018	$674,568
ADJUSTED INDIRECT CONTRACTOR COSTS	$132,294	$233,806	$472,197
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$793,763	$901,825	$1,146,765
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$753,281	$855,832	$1,088,280
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$75,328	$85,583	$108,828
TOTAL ADJUSTED FIELD COSTS	$828,609	$941,415	$1,197,108
ADJUSTED HEALTH AND SAFETY COST	$24,858	$47,071	$119,711
ADJUSTED CONTINGENCY COST	$82,861	$188,283	$359,132
ADJUSTED ENGINEERING COST	$41,430	$94,141	$239,422
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$977,759	$1,270,910	$1,915,373

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$73,890	$73,890	$73,890
ANNUAL SENSITIVE O&M COSTS	$49,800	$49,800	$49,800
ANNUAL SENSITIVE O&M COSTS * FACTOR	$99,600	$99,600	$99,600
SUBTOTAL (A)	$173,490	$173,490	$173,490
ADJUSTED CONTINGENCY COST	$17,349	$34,698	$52,047
SINKING FUND COST (U/F,TACC,10%,30-yr)	$5,944	$7,726	$11,644
ANNUAL OPERATION/MAINTENANCE COST (O/M)	$196,783	$215,914	$237,181
PRESENT WORTH (10%,30-yr) ON ANNUAL O/M	$1,855,058	$2,035,406	$2,235,887

TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$2,832,817	$3,306,316	$4,151,260
PERCENT RESPONSE TO ADJUSTMENTS	-14.3%	0.0%	25.6%

RAA NO. 3

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.3

Sensitivity Factor For Capital/O&M Costs: 0.50 SENALT31.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$672,689	$672,689	$672,689
SENSITIVE CAPTIAL COSTS	$356,450	$356,450	$356,450
SENSITIVE CAPITAL COSTS * FACTOR	$178,225	$178,225	$178,225
Subtotal (A)	$850,914	$850,914	$850,914
ADJUSTED SUBCONTRACTORS WORK	$85,091	$170,183	$255,274
SUBCONTRACTOR'S FEE	$8,509	$17,018	$25,527
BARE, DIRECT FIELD COST	$859,423	$867,932	$876,441
ADJUSTED INDIRECT CONTRACTOR COSTS	$171,885	$303,776	$613,509
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$1,031,308	$1,171,709	$1,489,950
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$978,711	$1,111,951	$1,413,963
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$97,871	$111,195	$141,396
TOTAL ADJUSTED FIELD COSTS	$1,076,582	$1,223,147	$1,555,359
ADJUSTED HEALTH AND SAFETY COST	$32,297	$61,157	$155,536
ADJUSTED CONTINGENCY COST	$107,658	$244,629	$466,608
ADJUSTED ENGINEERING COST	$53,829	$122,315	$311,072
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$1,270,367	$1,651,248	$2,488,575

ORIGINAL (Rev)

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$104,785	$104,785	$104,785
ANNUAL SENSITIVE O&M COSTS	$64,822	$64,822	$64,822
ANNUAL SENSITIVE O&M COSTS * FACTOR	$32,411	$32,411	$32,411
SUBTOTAL (A)	$137,196	$137,196	$137,196
ADJUSTED CONTINGENCY COST	$13,720	$27,439	$41,159
SINKING FUND COST (U/F,TACC,10%,30-yr)	$7,723	$10,039	$15,129
SINKING FUND COST ADJUSTMENT (FOR TECHNOLOGIES THAT WILL NOT BE DECOMMISSIONED -I.E.,PUBLIC WATER SUPPLY SYSTEM,SEEP EXCAVATION)	$5,709	$7,421	$11,184
ANNUAL OPERATION/MAINTENANCE COST (O/M)	$152,930	$167,253	$182,300
PRESENT WORTH (10%,30-yr) ON ANNUAL O/M	$1,441,654	$1,576,677	$1,718,524

TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$2,712,021	$3,227,925	$4,207,099
PERCENT RESPONSE TO ADJUSTMENTS	-16.0%	0.0%	30.3%

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.3

Sensitivity Factor For Capital/O&M Costs: 1.00 SENALT32.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$672,689	$672,689	$672,689
SENSITIVE CAPTIAL COSTS	$356,450	$356,450	$356,450
SENSITIVE CAPITAL COSTS * FACTOR	$356,450	$356,450	$356,450
Subtotal (A)	$1,029,139	$1,029,139	$1,029,139
ADJUSTED SUBCONTRACTORS WORK	$102,914	$205,828	$308,742
SUBCONTRACTOR'S FEE	$10,291	$20,583	$30,874
BARE, DIRECT FIELD COST	$1,039,430	$1,049,722	$1,060,013
ADJUSTED INDIRECT CONTRACTOR COSTS	$207,886	$367,403	$742,009
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$1,247,316	$1,417,124	$1,802,022
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$1,183,703	$1,344,851	$1,710,119
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$118,370	$134,485	$171,012
TOTAL ADJUSTED FIELD COSTS	$1,302,074	$1,479,336	$1,881,131
ADJUSTED HEALTH AND SAFETY COST	$39,062	$73,967	$188,113
ADJUSTED CONTINGENCY COST	$130,207	$295,867	$564,339
ADJUSTED ENGINEERING COST	$65,104	$147,934	$376,226
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$1,536,447	$1,997,104	$3,009,810

ORIGINAL (Red)

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$104,785	$104,785	$104,785
ANNUAL SENSITIVE O&M COSTS	$64,822	$64,822	$64,822
ANNUAL SENSITIVE O&M COSTS * FACTOR	$64,822	$64,822	$64,822
SUBTOTAL (A)	$169,607	$169,607	$169,607
ADJUSTED CONTINGENCY COST	$16,961	$33,921	$50,882
SINKING FUND COST (U/F,TACC,10%,30-yr)	$9,341	$12,141	$18,298
SINKING FUND COST ADJUSTMENT (FOR TECHNOLOGIES THAT WILL NOT BE DECOMMISSIONED -I.E.,PUBLIC WATER SUPPLY SYSTEM,SEEP EXCAVATION)	$6,588	$8,563	$12,906
ANNUAL OPERATION/MAINTENANCE COST (O/M)	$189,320	$207,107	$225,881
PRESENT WORTH (10%,30-yr) ON ANNUAL O/M	$1,784,706	$1,952,375	$2,129,359

TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$3,321,153	$3,949,479	$5,139,169
PERCENT RESPONSE TO ADJUSTMENTS	-15.9%	0.0%	30.1%

ORIGINAL (Red)

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.3

Sensitivity Factor For Capital/O&M Costs: 1.50 SENALT33.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$672,689	$672,689	$672,689
SENSITIVE CAPTIAL COSTS	$356,450	$356,450	$356,450
SENSITIVE CAPITAL COSTS * FACTOR	$534,675	$534,675	$534,675
Subtotal (A)	$1,207,364	$1,207,364	$1,207,364
ADJUSTED SUBCONTRACTORS WORK	$120,736	$241,473	$362,209
SUBCONTRACTOR'S FEE	$12,074	$24,147	$36,221
BARE, DIRECT FIELD COST	$1,219,438	$1,231,511	$1,243,585
ADJUSTED INDIRECT CONTRACTOR COSTS	$243,888	$431,029	$870,509
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$1,463,325	$1,662,540	$2,114,094
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$1,388,696	$1,577,751	$2,006,276
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$138,870	$157,775	$200,628
TOTAL ADJUSTED FIELD COSTS	$1,527,565	$1,735,526	$2,206,903
ADJUSTED HEALTH AND SAFETY COST	$45,827	$86,776	$220,690
ADJUSTED CONTINGENCY COST	$152,757	$347,105	$662,071
ADJUSTED ENGINEERING COST	$76,378	$173,553	$441,381
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$1,802,527	$2,342,960	$3,531,045

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$104,785	$104,785	$104,785
ANNUAL SENSITIVE O&M COSTS	$64,822	$64,822	$64,822
ANNUAL SENSITIVE O&M COSTS * FACTOR	$97,233	$97,233	$97,233
SUBTOTAL (A)	$202,018	$202,018	$202,018
ADJUSTED CONTINGENCY COST	$20,202	$40,404	$60,605
SINKING FUND COST (U/F,TACC,10%,30-yr)	$10,958	$14,244	$21,466
SINKING FUND COST ADJUSTMENT (FOR TECHNOLOGIES THAT WILL NOT BE DECOMMISSIONED -I.E.,PUBLIC WATER SUPPLY SYSTEM.SEEP EXCAVATION)	$7,467	$9,706	$14,628
ANNUAL OPERATION/MAINTENANCE COST (O/M)	$225,711	$246,959	$269,462
PRESENT WORTH (10%,30-yr) ON ANNUAL O/M	$2,127,758	$2,328,064	$2,540,194
TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$3,930,285	$4,671,024	$6,071,239
PERCENT RESPONSE TO ADJUSTMENTS	-15.9%	0.0%	30.0%

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.3

Sensitivity Factor For Capital/O&M Costs: 2.00 SENALT34.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$672,689	$672,689	$672,689
SENSITIVE CAPTIAL COSTS	$356,450	$356,450	$356,450
SENSITIVE CAPITAL COSTS * FACTOR	$712,900	$712,900	$712,900
Subtotal (A)	$1,385,589	$1,385,589	$1,385,589
ADJUSTED SUBCONTRACTORS WORK	$138,559	$277,118	$415,677
SUBCONTRACTOR'S FEE	$13,856	$27,712	$41,568
BARE, DIRECT FIELD COST	$1,399,445	$1,413,301	$1,427,157
ADJUSTED INDIRECT CONTRACTOR COSTS	$279,889	$494,655	$999,010
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$1,679,334	$1,907,956	$2,426,166
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$1,593,688	$1,810,650	$2,302,432
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$159,369	$181,065	$230,243
TOTAL ADJUSTED FIELD COSTS	$1,753,057	$1,991,715	$2,532,675
ADJUSTED HEALTH AND SAFETY COST	$52,592	$99,586	$253,268
ADJUSTED CONTINGENCY COST	$175,306	$398,343	$759,803
ADJUSTED ENGINEERING COST	$87,653	$199,172	$506,535
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$2,068,607	$2,688,816	$4,052,280

ORIGINAL (red)

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$104,785	$104,785	$104,785
ANNUAL SENSITIVE O&M COSTS	$64,822	$64,822	$64,822
ANNUAL SENSITIVE O&M COSTS * FACTOR	$129,644	$129,644	$129,644
SUBTOTAL (A)	$234,429	$234,429	$234,429
ADJUSTED CONTINGENCY COST	$23,443	$46,886	$70,329
SINKING FUND COST (U/F,TACC,10%,30-yr)	$12,576	$16,346	$24,635
SINKING FUND COST ADJUSTMENT (FOR TECHNOLOGIES THAT WILL NOT BE DECOMMISSIONED -I.E.,PUBLIC WATER SUPPLY SYSTEM,DEEP EXCAVATION)	$8,346	$10,849	$16,350
ANNUAL OPERATION & MAINTENANCE COST (O/M)	$262,102	$286,812	$313,043
PRESENT WORTH (10%,30-yr) ON ANNUAL O/M	$2,470,810	$2,703,753	$2,951,029
TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$4,539,417	$5,392,569	$7,003,309
PERCENT RESPONSE TO ADJUSTMENTS	-15.8%	0.0%	29.9%

RAA NO. 4

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.4

Sensitivity Factor For Capital/O&M Costs: 0.50 SENALT41.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$1,887,038	$1,887,038	$1,887,038
SENSITIVE CAPTIAL COSTS	$781,260	$781,260	$781,260
SENSITIVE CAPITAL COSTS * FACTOR	$390,630	$390,630	$390,630
Subtotal (A)	$2,277,668	$2,277,668	$2,277,668
ADJUSTED SUBCONTRACTORS WORK	$227,767	$455,534	$683,300
SUBCONTRACTOR'S FEE	$22,777	$45,553	$68,330
BARE, DIRECT FIELD COST	$2,300,445	$2,323,221	$2,345,998
ADJUSTED INDIRECT CONTRACTOR COSTS	$460,089	$813,127	$1,642,199
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$2,760,534	$3,136,349	$3,988,197
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$2,619,746	$2,976,395	$3,784,799
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$261,975	$297,640	$378,480
TOTAL ADJUSTED FIELD COSTS	$2,881,721	$3,274,035	$4,163,279
ADJUSTED HEALTH AND SAFETY COST	$86,452	$163,702	$416,328
ADJUSTED CONTINGENCY COST	$288,172	$654,807	$1,248,984
ADJUSTED ENGINEERING COST	$144,086	$327,403	$832,656
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$3,400,431	$4,419,947	$6,661,246

ORIGINAL (Red)

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$558,911	$558,911	$558,911
ANNUAL SENSITIVE O&M COSTS	$126,160	$126,160	$126,160
ANNUAL SENSITIVE O&M COSTS * FACTOR	$63,080	$63,080	$63,080
SUBTOTAL (A)	$621,991	$621,991	$621,991
ADJUSTED CONTINGENCY COST	$62,199	$124,398	$186,597
SINKING FUND COST (U/F,TACC,10%,30-yr)	$20,672	$26,870	$40,496
SINKING FUND COST ADJUSTMENT (FOR TECHNOLOGIES THAT WILL NOT BE DECOMMISSIONED -I.E.,PUBLIC WATER SUPPLY SYSTEM,SEEP EXCAVATION)	$5,709	$7,421	$11,184
ANNUAL OPERATION/MAINTENANCE COST (O/M)	$699,154	$765,839	$837,900
PRESENT WORTH (10%,30-yr) ON ANNUAL O/M	$6,590,861	$7,219,495	$7,898,815

TOTAL ADJUSTED ALTERNATIVE COSTS ---- (PRESENT WORTH)	$9,991,291	$11,639,442	$14,560,061
PERCENT RESPONSE TO ADJUSTMENTS	-14.2%	0.0%	25.1%

ORIGINAL (Red)

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.4

Sensitivity Factor For Capital/O&M Costs: 1.00 SENALT42.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$1,887,038	$1,887,038	$1,887,038
SENSITIVE CAPTIAL COSTS	$781,260	$781,260	$781,260
SENSITIVE CAPITAL COSTS * FACTOR	$781,260	$781,260	$781,260
Subtotal (A)	$2,668,298	$2,668,298	$2,668,298
ADJUSTED SUBCONTRACTORS WORK	$266,830	$533,660	$800,489
SUBCONTRACTOR'S FEE	$26,683	$53,366	$80,049
BARE, DIRECT FIELD COST	$2,694,981	$2,721,664	$2,748,347
ADJUSTED INDIRECT CONTRACTOR COSTS	$538,996	$952,582	$1,923,843
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$3,233,977	$3,674,246	$4,672,190
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$3,069,044	$3,486,860	$4,433,908
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$306,904	$348,686	$443,391
TOTAL ADJUSTED FIELD COSTS	$3,375,949	$3,835,546	$4,877,299
ADJUSTED HEALTH AND SAFETY COST	$101,278	$191,777	$487,730
ADJUSTED CONTINGENCY COST	$337,595	$767,109	$1,463,190
ADJUSTED ENGINEERING COST	$168,797	$383,555	$975,460
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$3,983,620	$5,177,987	$7,803,678

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$558,911	$558,911	$558,911
ANNUAL SENSITIVE O&M COSTS	$126,160	$126,160	$126,160
ANNUAL SENSITIVE O&M COSTS * FACTOR	$126,160	$126,160	$126,160
SUBTOTAL (A)	$685,071	$685,071	$685,071
ADJUSTED CONTINGENCY COST	$68,507	$137,014	$205,521
SINKING FUND COST (U/F,TACC,10%,30-yr)	$24,218	$31,479	$47,441
SINKING FUND COST ADJUSTMENT (FOR TECHNOLOGIES THAT WILL NOT BE DECOMMISSIONED -I.E.,PUBLIC WATER SUPPLY SYSTEM,SEEP EXCAVATION)	$6,588	$8,563	$12,906
ANNUAL OPERATION/MAINTENANCE COST (O/M)	$771,208	$845,001	$925,128
PRESENT WORTH (10%,30-yr) ON ANNUAL O/M	$7,270,111	$7,965,753	$8,721,099
TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$11,253,731	$13,143,739	$16,524,778
PERCENT RESPONSE TO ADJUSTMENTS	-14.4%	0.0%	25.7%

ORIGINAL (Red)

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.4

Sensitivity Factor For Capital/O&M Costs: 1.50 SENALT43.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$1,887,038	$1,887,038	$1,887,038
SENSITIVE CAPITAL COSTS	$781,260	$781,260	$781,260
SENSITIVE CAPITAL COSTS * FACTOR	$1,171,890	$1,171,890	$1,171,890
Subtotal (A)	$3,058,928	$3,058,928	$3,058,928
ADJUSTED SUBCONTRACTORS WORK	$305,893	$611,786	$917,678
SUBCONTRACTOR'S FEE	$30,589	$61,179	$91,768
BARE, DIRECT FIELD COST	$3,089,517	$3,120,107	$3,150,696
ADJUSTED INDIRECT CONTRACTOR COSTS	$617,903	$1,092,037	$2,205,487
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$3,707,421	$4,212,144	$5,356,183
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$3,518,342	$3,997,325	$5,083,018
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$351,834	$399,732	$508,302
TOTAL ADJUSTED FIELD COSTS	$3,870,177	$4,397,057	$5,591,319
ADJUSTED HEALTH AND SAFETY COST	$116,105	$219,853	$559,132
ADJUSTED CONTINGENCY COST	$387,018	$879,411	$1,677,396
ADJUSTED ENGINEERING COST	$193,509	$439,706	$1,118,264
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$4,566,808	$5,936,027	$8,946,111

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$558,911	$558,911	$558,911
ANNUAL SENSITIVE O&M COSTS	$126,160	$126,160	$126,160
ANNUAL SENSITIVE O&M COSTS * FACTOR	$189,240	$189,240	$189,240
SUBTOTAL (A)	$748,151	$748,151	$748,151
ADJUSTED CONTINGENCY COST	$74,815	$149,630	$224,445
SINKING FUND COST (U/F,TACC,10%,30-yr)	$27,763	$36,087	$54,387
SINKING FUND COST ADJUSTMENT (FOR TECHNOLOGIES THAT WILL NOT BE DECOMMISSIONED -I.E.,PUBLIC WATER SUPPLY SYSTEM,SEEP EXCAVATION)	$7,467	$9,706	$14,628
ANNUAL OPERATION/MAINTENANCE COST (O/M)	$843,262	$924,162	$1,012,355
PRESENT WORTH (10%,30-yr) OM ANNUAL O/M	$7,949,362	$8,712,000	$9,543,383

TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$12,516,171	$14,648,027	$18,489,494
PERCENT RESPONSE TO ADJUSTMENTS	-14.6%	0.0%	26.2%

ORIGINAL (Red)

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.4

Sensitivity Factor For Capital/O&M Costs: 2.00 SENALT44.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$1,887,038	$1,887,038	$1,887,038
SENSITIVE CAPTIAL COSTS	$781,260	$781,260	$781,260
SENSITIVE CAPITAL COSTS * FACTOR	$1,562,520	$1,562,520	$1,562,520
Subtotal (A)	$3,449,558	$3,449,558	$3,449,558
ADJUSTED SUBCONTRACTORS WORK	$344,956	$689,912	$1,034,867
SUBCONTRACTOR'S FEE	$34,496	$68,991	$103,487
BARE, DIRECT FIELD COST	$3,484,054	$3,518,549	$3,553,045
ADJUSTED INDIRECT CONTRACTOR COSTS	$696,811	$1,231,492	$2,487,131
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$4,180,864	$4,750,041	$6,040,176
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$3,967,640	$4,507,789	$5,732,127
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$396,764	$450,779	$573,213
TOTAL ADJUSTED FIELD COSTS	$4,364,404	$4,958,568	$6,305,340
ADJUSTED HEALTH AND SAFETY COST	$130,932	$247,928	$630,534
ADJUSTED CONTINGENCY COST	$436,440	$991,714	$1,891,602
ADJUSTED ENGINEERING COST	$218,220	$495,857	$1,261,068
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$5,149,997	$6,694,067	$10,088,544

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$558,911	$558,911	$558,911
ANNUAL SENSITIVE O&M COSTS	$126,160	$126,160	$126,160
ANNUAL SENSITIVE O&M COSTS * FACTOR	$252,320	$252,320	$252,320
SUBTOTAL (A)	$811,231	$811,231	$811,231
ADJUSTED CONTINGENCY COST	$81,123	$162,246	$243,369
SINKING FUND COST (U/F,TACC,10%,30-yr)	$31,309	$40,696	$61,332
SINKING FUND COST ADJUSTMENT (FOR TECHNOLOGIES THAT WILL NOT BE DECOMMISSIONED -I.E..PUBLIC WATER SUPPLY SYSTEM,SEEP EXCAVATION)	$8,346	$10,849	$16,350
ANNUAL OPERATION/MAINTENANCE COST (O/M)	$915,317	$1,003,324	$1,099,582
PRESENT WORTH (10%,30-yr) ON ANNUAL O/M	$8,628,613	$9,458,248	$10,365,667

TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$13,778,610	$16,152,315	$20,454,211
PERCENT RESPONSE TO ADJUSTMENTS	-14.7%	0.0%	26.6%

ORIGINAL
(Red)

RAA NO. 5

AR301221

ORIGINAL (Red)

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.5

Sensitivity Factor For Capital/O&M Costs: 0.50 SENALT5[illegible]

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$1,793,439	$1,793,439	$1,793,439
SENSITIVE CAPTIAL COSTS	$750,360	$750,360	$750,360
SENSITIVE CAPITAL COSTS * FACTOR	$375,180	$375,180	$375,180
Subtotal (A)	$2,168,619	$2,168,619	$2,168,619
ADJUSTED SUBCONTRACTORS WORK	$216,862	$433,724	$650,586
SUBCONTRACTOR'S FEE	$21,686	$43,372	$65,059
BARE, DIRECT FIELD COST	$2,190,305	$2,211,991	$2,233,678
ADJUSTED INDIRECT CONTRACTOR COSTS	$438,061	$774,197	$1,563,574
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$2,628,366	$2,986,188	$3,797,252
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$2,494,320	$2,833,893	$3,603,592
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$249,432	$283,389	$360,359
TOTAL ADJUSTED FIELD COSTS	$2,743,752	$3,117,282	$3,963,951
ADJUSTED HEALTH AND SAFETY COST	$82,313	$155,864	$396,398
ADJUSTED CONTINGENCY COST	$274,375	$623,456	$1,189,185
ADJUSTED ENGINEERING COST	$137,188	$311,728	$792,790
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$3,237,627	$4,208,331	$6,342,322

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$641,386	$641,386	$641,386
ANNUAL SENSITIVE O&M COSTS	$114,117	$114,117	$114,117
ANNUAL SENSITIVE O&M COSTS * FACTOR	$57,059	$57,059	$57,059
SUBTOTAL (A)	$698,445	$698,445	$698,445
ADJUSTED CONTINGENCY COST	$69,844	$139,689	$209,533
SINKING FUND COST (U/F,TACC,10%,30-yr)	$19,683	$25,584	$38,557
SINKING FUND COST ADJUSTMENT (FOR TECHNOLOGIES THAT WILL NOT BE DECOMMISSIONED -I.E.,PUBLIC WATER SUPPLY SYSTEM,SEEP EXCAVATION)	$5,709	$7,421	$11,184
ANNUAL OPERATION/MAINTENANCE COST (O/M)	$782,263	$856,296	$935,351
PRESENT WORTH (10%,30-yr) ON ANNUAL O/M	$7,374,323	$8,072,233	$8,817,475

TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$10,611,950	$12,280,563	$15,159,797
PERCENT RESPONSE TO ADJUSTMENTS	-13.6%	0.0%	23.4%

ORIGINAL (Red)

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.5

Sensitivity Factor For Capital/O&M Costs: 1.00 SENALT52.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$1,793,439	$1,793,439	$1,793,439
SENSITIVE CAPTIAL COSTS	$750,360	$750,360	$750,360
SENSITIVE CAPITAL COSTS * FACTOR	$750,360	$750,360	$750,360
Subtotal (A)	$2,543,799	$2,543,799	$2,543,799
ADJUSTED SUBCONTRACTORS WORK	$254,380	$508,760	$763,140
SUBCONTRACTOR'S FEE	$25,438	$50,876	$76,314
BARE, DIRECT FIELD COST	$2,569,237	$2,594,675	$2,620,113
ADJUSTED INDIRECT CONTRACTOR COSTS	$513,847	$908,136	$1,834,079
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$3,083,084	$3,502,811	$4,454,192
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$2,925,847	$3,324,168	$4,227,028
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$292,585	$332,417	$422,703
TOTAL ADJUSTED FIELD COSTS	$3,218,432	$3,656,585	$4,649,731
ADJUSTED HEALTH AND SAFETY COST	$96,553	$182,829	$464,973
ADJUSTED CONTINGENCY COST	$321,843	$731,317	$1,394,919
ADJUSTED ENGINEERING COST	$160,922	$365,658	$929,946
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$3,797,750	$4,936,389	$7,439,570

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$641,386	$641,386	$641,386
ANNUAL SENSITIVE O&M COSTS	$114,117	$114,117	$114,117
ANNUAL SENSITIVE O&M COSTS * FACTOR	$114,117	$114,117	$114,117
SUBTOTAL (A)	$755,503	$755,503	$755,503
ADJUSTED CONTINGENCY COST	$75,550	$151,101	$226,651
SINKING FUND COST (U/F,TACC,10%,30-yr)	$23,088	$30,010	$45,228
SINKING FUND COST ADJUSTMENT (FOR TECHNOLOGIES THAT WILL NOT BE DECOMMISSIONED -I.E.,PUBLIC WATER SUPPLY SYSTEM,SEEP EXCAVATION)	$6,588	$8,563	$12,906
ANNUAL OPERATION/MAINTENANCE COST (O/M)	$847,553	$928,051	$1,014,476
PRESENT WORTH (10%,30-yr) ON ANNUAL O/M	$7,989,811	$8,748,654	$9,563,376
TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$11,787,561	$13,685,044	$17,002,946
PERCENT RESPONSE TO ADJUSTMENTS	-13.9%	0.0%	24.2%

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.5

Sensitivity Factor For Capital/O&M Costs: 1.50 SENALT53.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$1,793,439	$1,793,439	$1,793,439
SENSITIVE CAPTIAL COSTS	$750,360	$750,360	$750,360
SENSITIVE CAPITAL COSTS * FACTOR	$1,125,540	$1,125,540	$1,125,540
Subtotal (A)	$2,918,979	$2,918,979	$2,918,979
ADJUSTED SUBCONTRACTORS WORK	$291,898	$583,796	$875,694
SUBCONTRACTOR'S FEE	$29,190	$58,380	$87,569
BARE, DIRECT FIELD COST	$2,948,169	$2,977,359	$3,006,548
ADJUSTED INDIRECT CONTRACTOR COSTS	$589,634	$1,042,076	$2,104,584
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$3,537,803	$4,019,434	$5,111,132
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$3,357,375	$3,814,443	$4,850,464
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$335,737	$381,444	$485,046
TOTAL ADJUSTED FIELD COSTS	$3,693,112	$4,195,887	$5,335,511
ADJUSTED HEALTH AND SAFETY COST	$110,793	$209,794	$533,551
ADJUSTED CONTINGENCY COST	$369,311	$839,177	$1,600,653
ADJUSTED ENGINEERING COST	$184,656	$419,589	$1,067,102
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$4,357,872	$5,664,448	$8,536,817

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$641,386	$641,386	$641,386
ANNUAL SENSITIVE O&M COSTS	$114,117	$114,117	$114,117
ANNUAL SENSITIVE O&M COSTS * FACTOR	$171,176	$171,176	$171,176
SUBTOTAL (A)	$812,562	$812,562	$812,562
ADJUSTED CONTINGENCY COST	$81,256	$162,512	$243,768
SINKING FUND COST (U/F,TACC,10%,30-yr)	$26,493	$34,436	$51,898
SINKING FUND COST ADJUSTMENT (FOR TECHNOLOGIES THAT WILL NOT BE DECOMMISSIONED -I.E.,PUBLIC WATER SUPPLY SYSTEM,SEEP EXCAVATION)	$7,467	$9,706	$14,628
ANNUAL OPERATION MAINTENANCE COST (O/M)	$912,844	$999,804	$1,093,600
PRESENT WORTH (10%,30-yr) ON ANNUAL O/M	$8,605,300	$9,425,067	$10,309,277
TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$12,963,172	$15,089,515	$18,846,094
PERCENT RESPONSE TO ADJUSTMENTS	-14.1%	0.0%	24.9%

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.5

Sensitivity Factor For Capital/O&M Costs: 2.00 SENALT54.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$1,793,439	$1,793,439	$1,793,439
SENSITIVE CAPTIAL COSTS	$750,360	$750,360	$750,360
SENSITIVE CAPITAL COSTS * FACTOR	$1,500,720	$1,500,720	$1,500,720
Subtotal (A)	$3,294,159	$3,294,159	$3,294,159
ADJUSTED SUBCONTRACTORS WORK	$329,416	$658,832	$988,248
SUBCONTRACTOR'S FEE	$32,942	$65,883	$98,825
BARE, DIRECT FIELD COST	$3,327,101	$3,360,042	$3,392,984
ADJUSTED INDIRECT CONTRACTOR COSTS	$665,420	$1,176,015	$2,375,089
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$3,992,521	$4,536,057	$5,768,072
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$3,788,902	$4,304,718	$5,473,901
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$378,890	$430,472	$547,390
TOTAL ADJUSTED FIELD COSTS	$4,167,792	$4,735,190	$6,021,291
ADJUSTED HEALTH AND SAFETY COST	$125,034	$236,759	$602,129
ADJUSTED CONTINGENCY COST	$416,779	$947,038	$1,806,387
ADJUSTED ENGINEERING COST	$208,390	$473,519	$1,204,258
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$4,917,995	$6,392,506	$9,634,065

ORIGINAL (Red)

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$641,386	$641,386	$641,386
ANNUAL SENSITIVE O&M COSTS	$114,117	$114,117	$114,117
ANNUAL SENSITIVE O&M COSTS * FACTOR	$228,234	$228,234	$228,234
SUBTOTAL (A)	$869,620	$869,620	$869,620
ADJUSTED CONTINGENCY COST	$86,962	$173,924	$260,886
SINKING FUND COST (U/F,TACC,10%,30-yr)	$29,898	$38,862	$58,569
SINKING FUND COST ADJUSTMENT (FOR TECHNOLOGIES THAT WILL NOT BE DECOMMISSIONED -I.E.,PUBLIC WATER SUPPLY SYSTEM,SEEP EXCAVATION)	$8,346	$10,849	$16,350
ANNUAL OPERATION/MAINTENANCE COST (O/M)	$978,134	$1,071,557	$1,172,725
PRESENT WORTH (10%,30-yr) OH ANNUAL O/M	$9,220,788	$10,101,479	$11,055,178

TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$14,138,783	$16,493,986	$20,689,243
PERCENT RESPONSE TO ADJUSTMENTS	-14.3%	0.0%	25.4%

RAA NO. 6

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.6

Sensitivity Factor For Capital/O&M Costs: 0.50 SLENALT61.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$2,231,503	$2,231,503	$2,231,503
SENSITIVE CAPTIAL COSTS	$898,180	$898,180	$898,180
SENSITIVE CAPITAL COSTS * FACTOR	$449,090	$449,090	$449,090
Subtotal (A)	$2,680,593	$2,680,593	$2,680,593
ADJUSTED SUBCONTRACTORS WORK	$268,059	$536,119	$804,178
SUBCONTRACTOR'S FEE	$26,806	$53,612	$80,418
BARE, DIRECT FIELD COST	$2,707,399	$2,734,205	$2,761,011
ADJUSTED INDIRECT CONTRACTOR COSTS	$541,480	$956,972	$1,932,708
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$3,248,879	$3,691,177	$4,693,719
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$3,083,186	$3,502,927	$4,454,339
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$308,319	$350,293	$445,434
TOTAL ADJUSTED FIELD COSTS	$3,391,504	$3,853,219	$4,899,773
ADJUSTED HEALTH AND SAFETY COST	$101,745	$192,661	$489,977
ADJUSTED CONTINGENCY COST	$339,150	$770,644	$1,469,932
ADJUSTED ENGINEERING COST	$169,575	$385,322	$979,955
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$4,001,975	$5,201,846	$7,839,636

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$575,651	$575,651	$575,651
ANNUAL SENSITIVE O&M COSTS	$117,558	$117,558	$117,558
ANNUAL SENSITIVE O&M COSTS * FACTOR	$58,779	$58,779	$58,779
SUBTOTAL (A)	$634,430	$634,430	$634,430
ADJUSTED CONTINGENCY COST	$63,443	$126,886	$190,329
SINKING FUND COST (U/F,TACC,10%,30-yr)	$24,329	$31,624	$47,660
SINKING FUND COST ADJUSTMENT (FOR TECHNOLOGIES THAT WILL NOT BE DECOMMISSIONED -I.E.,PUBLIC WATER SUPPLY SYSTEM,SEEP EXCAVATION)	$5,709	$7,421	$11,184
ANNUAL OPERATION/MAINTENANCE COST (O/M)	$716,493	$785,519	$861,235
PRESENT WORTH (10%,30-yr) ON ANNUAL O/M	$6,754,322	$7,405,019	$8,118,788

TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$10,756,298	$12,606,865	$15,958,425
PERCENT RESPONSE TO ADJUSTMENTS	-14.7%	0.0%	26.6%

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.6

Sensitivity Factor For Capital/O&M Costs: 1.00 SLEMALT62.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$2,231,503	$2,231,503	$2,231,503
SENSITIVE CAPTIAL COSTS	$898,180	$898,180	$898,180
SENSITIVE CAPITAL COSTS * FACTOR	$898,180	$898,180	$898,180
Subtotal (A)	$3,129,683	$3,129,683	$3,129,683
ADJUSTED SUBCONTRACTORS WORK	$312,968	$625,937	$938,905
SUBCONTRACTOR'S FEE	$31,297	$62,594	$93,890
BARE. DIRECT FIELD COST	$3,160,980	$3,192,277	$3,223,573
ADJUSTED INDIRECT CONTRACTOR COSTS	$632,196	$1,117,297	$2,256,501
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$3,793,176	$4,309,573	$5,480,075
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$3,599,724	$4,089,785	$5,200,591
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$359,972	$408,979	$520,059
TOTAL ADJUSTED FIELD COSTS	$3,959,696	$4,498,764	$5,720,650
ADJUSTED HEALTH AND SAFETY COST	$118,791	$224,938	$572,065
ADJUSTED CONTINGENCY COST	$395,970	$899,753	$1,716,195
ADJUSTED ENGINEERING COST	$197,985	$449,876	$1,144,130
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$4,672,442	$6,073,331	$9,153,040

ORIGINAL (Red)

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$575,651	$575,651	$575,651
ANNUAL SENSITIVE O&M COSTS	$117,558	$117,558	$117,558
ANNUAL SENSITIVE O&M COSTS * FACTOR	$117,558	$117,558	$117,558
SUBTOTAL (A)	$693,209	$693,209	$693,209
ADJUSTED CONTINGENCY COST	$69,321	$138,642	$207,963
SINKING FUND COST (U/F,TACC,10%,30-yr)	$28,405	$36,922	$55,645
SINKING FUND COST ADJUSTMENT (FOR TECHNOLOGIES THAT WILL NOT BE DECOMMISSIONED -I.E.,PUBLIC WATER SUPPLY SYSTEM,SEEP EXCAVATION)	$6,588	$8,563	$12,906
ANNUAL OPERATION/MAINTENANCE COST (O/M)	$784,347	$860,210	$943,910
PRESENT WORTH (10%,30-yr) ON ANNUAL O/M	$7,393,975	$8,109,124	$8,898,162
TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$12,066,417	$14,182,455	$18,051,202
PERCENT RESPONSE TO ADJUSTMENTS	-14.9%	0.0%	27.3%

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.6

Sensitivity Factor For Capital/O&M Costs: 1.50 SENALT63.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$2,231,503	$2,231,503	$2,231,503
SENSITIVE CAPITAL COSTS	$898,180	$898,180	$898,180
SENSITIVE CAPITAL COSTS * FACTOR	$1,347,270	$1,347,270	$1,347,270
Subtotal (A)	$3,578,773	$3,578,773	$3,578,773
ADJUSTED SUBCONTRACTORS WORK	$357,877	$715,755	$1,073,632
SUBCONTRACTOR'S FEE	$35,788	$71,575	$107,363
BARE, DIRECT FIELD COST	$3,614,561	$3,650,348	$3,686,136
ADJUSTED INDIRECT CONTRACTOR COSTS	$722,912	$1,277,622	$2,580,295
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$4,337,473	$4,927,970	$6,266,432
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$4,116,262	$4,676,644	$5,946,844
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$411,626	$467,664	$594,684
TOTAL ADJUSTED FIELD COSTS	$4,527,888	$5,144,308	$6,541,528
ADJUSTED HEALTH AND SAFETY COST	$135,837	$257,215	$654,153
ADJUSTED CONTINGENCY COST	$452,789	$1,028,862	$1,962,458
ADJUSTED ENGINEERING COST	$226,394	$514,431	$1,308,306
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$5,342,908	$6,944,816	$10,466,445

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$575,651	$575,651	$575,651
ANNUAL SENSITIVE O&M COSTS	$117,558	$117,558	$117,558
ANNUAL SENSITIVE O&M COSTS * FACTOR	$176,337	$176,337	$176,337
SUBTOTAL (A)	$751,988	$751,988	$751,988
ADJUSTED CONTINGENCY COST	$75,199	$150,398	$225,596
SINKING FUND COST (U/F,TACC,10%,30-yr)	$32,481	$42,220	$63,629
SINKING FUND COST ADJUSTMENT (FOR TECHNOLOGIES THAT WILL NOT BE DECOMMISSIONED -I.E.,PUBLIC WATER SUPPLY SYSTEM,SEEP EXCAVATION)	$7,467	$9,706	$14,628
ANNUAL OPERATION/MAINTENANCE COST (O/M)	$852,201	$934,900	$1,026,586
PRESENT WORTH (10%,30-yr) ON ANNUAL O/M	$8,033,628	$8,813,219	$9,677,535
TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$13,376,536	$15,758,035	$20,143,980
PERCENT RESPONSE TO ADJUSTMENTS	-15.1%	0.0%	27.8%

ORIGINAL (Red)

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.6

Sensitivity Factor For Capital/O&M Costs: 2.00 SENALT64.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$2,231,503	$2,231,503	$2,231,503
SENSITIVE CAPTIAL COSTS	$898,180	$898,180	$898,180
SENSITIVE CAPITAL COSTS * FACTOR	$1,796,360	$1,796,360	$1,796,360
Subtotal (A)	$4,027,863	$4,027,863	$4,027,863
ADJUSTED SUBCONTRACTORS WORK	$402,786	$805,573	$1,208,359
SUBCONTRACTOR'S FEE	$40,279	$80,557	$120,836
BARE, DIRECT FIELD COST	$4,068,142	$4,108,420	$4,148,699
ADJUSTED INDIRECT CONTRACTOR COSTS	$813,628	$1,437,947	$2,904,089
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$4,881,770	$5,546,367	$7,052,788
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$4,632,800	$5,263,503	$6,693,096
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$463,280	$526,350	$669,310
TOTAL ADJUSTED FIELD COSTS	$5,096,080	$5,789,853	$7,362,406
ADJUSTED HEALTH AND SAFETY COST	$152,882	$289,493	$736,241
ADJUSTED CONTINGENCY COST	$509,608	$1,157,971	$2,208,722
ADJUSTED ENGINEERING COST	$254,804	$578,985	$1,472,481
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$6,013,374	$7,816,301	$11,779,849

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$575,651	$575,651	$575,651
ANNUAL SENSITIVE O&M COSTS	$117,558	$117,558	$117,558
ANNUAL SENSITIVE O&M COSTS * FACTOR	$235,116	$235,116	$235,116
SUBTOTAL (A)	$810,767	$810,767	$810,767
ADJUSTED CONTINGENCY COST	$81,077	$162,153	$243,230
SINKING FUND COST (U/F,TACC,10%,30-yr)	$36,557	$47,518	$71,614
SINKING FUND COST ADJUSTMENT (FOR TECHNOLOGIES THAT WILL NOT BE DECOMMISSIONED -I.E.,PUBLIC WATER SUPPLY SYSTEM,SEEP EXCAVATION)	$8,346	$10,849	$16,350
ANNUAL OPERATION/MAINTENANCE COST (O/M)	$920,055	$1,009,590	$1,109,261
PRESENT WORTH (10%,30-yr) OF ANNUAL O/M	$8,673,281	$9,517,314	$10,456,909
TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$14,686,655	$17,333,615	$22,236,758
PERCENT RESPONSE TO ADJUSTMENTS	-15.3%	0.0%	28.3%

RAA NO. 7

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.7

Sensitivity Factor For Capital/O&M Costs: 0.50 SENALT71.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$2,137,904	$2,137,904	$2,137,904
SENSITIVE CAPTIAL COSTS	$867,280	$867,280	$867,280
SENSITIVE CAPITAL COSTS * FACTOR	$433,640	$433,640	$433,640
Subtotal (A)	$2,571,544	$2,571,544	$2,571,544
ADJUSTED SUBCONTRACTORS WORK	$257,154	$514,309	$771,463
SUBCONTRACTOR'S FEE	$25,715	$51,431	$77,146
BARE, DIRECT FIELD COST	$2,597,259	$2,622,975	$2,648,690
ADJUSTED INDIRECT CONTRACTOR COSTS	$519,452	$918,041	$1,854,083
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$3,116,711	$3,541,016	$4,502,774
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$2,957,759	$3,360,424	$4,273,132
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$295,776	$336,042	$427,313
TOTAL ADJUSTED FIELD COSTS	$3,253,535	$3,696,467	$4,700,445
ADJUSTED HEALTH AND SAFETY COST	$97,606	$184,823	$470,045
ADJUSTED CONTINGENCY COST	$325,353	$739,293	$1,410,134
ADJUSTED ENGINEERING COST	$162,677	$369,647	$940,089
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$3,839,171	$4,990,230	$7,520,712

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$658,126	$658,126	$658,126
ANNUAL SENSITIVE O&M COSTS	$105,515	$105,515	$105,515
ANNUAL SENSITIVE O&M COSTS * FACTOR	$52,758	$52,758	$52,758
SUBTOTAL (A)	$710,884	$710,884	$710,884
ADJUSTED CONTINGENCY COST	$71,088	$142,177	$213,265
SINKING FUND COST (U/F,TACC,10%,30-yr)	$23,340	$30,337	$45,721
SINKING FUND COST ADJUSTMENT (FOR TECHNOLOGIES THAT WILL NOT BE DECOMMISSIONED -I.E.,PUBLIC WATER SUPPLY SYSTEM,SEEP EXCAVATION)	$5,709	$7,421	$11,184
ANNUAL OPERATION/MAINTENANCE COST (O/M)	$799,603	$875,977	$958,686
PRESENT WORTH (10%,30-yr) ON ANNUAL O/M	$7,537,785	$8,257,757	$9,037,448
TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$11,376,956	$13,247,987	$16,558,160
PERCENT RESPONSE TO ADJUSTMENTS	-14.1%	0.0%	25.0%

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.7

Sensitivity Factor For Capital/O&M Costs: 1.00 SENALT72.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$2,137,904	$2,137,904	$2,137,904
SENSITIVE CAPITAL COSTS	$867,280	$867,280	$867,280
SENSITIVE CAPITAL COSTS * FACTOR	$867,280	$867,280	$867,280
Subtotal (A)	$3,005,184	$3,005,184	$3,005,184
ADJUSTED SUBCONTRACTORS WORK	$300,518	$601,037	$901,555
SUBCONTRACTOR'S FEE	$30,052	$60,104	$90,156
BARE, DIRECT FIELD COST	$3,035,236	$3,065,288	$3,095,340
ADJUSTED INDIRECT CONTRACTOR COSTS	$607,047	$1,072,851	$2,166,738
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$3,642,283	$4,138,138	$5,262,077
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$3,456,527	$3,927,093	$4,993,711
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$345,653	$392,709	$499,371
TOTAL ADJUSTED FIELD COSTS	$3,802,179	$4,319,803	$5,493,082
ADJUSTED HEALTH AND SAFETY COST	$114,065	$215,990	$549,308
ADJUSTED CONTINGENCY COST	$380,218	$863,961	$1,647,925
ADJUSTED ENGINEERING COST	$190,109	$431,980	$1,098,616
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$4,486,571	$5,831,734	$8,788,932

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$658,126	$658,126	$658,126
ANNUAL SENSITIVE O&M COSTS	$105,515	$105,515	$105,515
ANNUAL SENSITIVE O&M COSTS * FACTOR	$105,515	$105,515	$105,515
SUBTOTAL (A)	$763,641	$763,641	$763,641
ADJUSTED CONTINGENCY COST	$76,364	$152,728	$229,092
SINKING FUND COST (U/F,TACC,10%,30-yr)	$27,275	$35,453	$53,431
SINKING FUND COST ADJUSTMENT (FOR TECHNOLOGIES THAT WILL NOT BE DECOMMISSIONED -I.E.,PUBLIC WATER SUPPLY SYSTEM,SEEP EXCAVATION)	$6,588	$8,563	$12,906
ANNUAL OPERATION/MAINTENANCE COST (O/M)	$860,693	$943,259	$1,033,258
PRESENT WORTH (10%,30-yr) ON ANNUAL O/M	$8,113,675	$8,892,026	$9,740,438
TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$12,600,247	$14,723,759	$18,529,370
PERCENT RESPONSE TO ADJUSTMENTS	-14.4%	0.0%	25.8%

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.7

Sensitivity Factor For Capital/O&M Costs: 1.50 SENALT73.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$2,137,904	$2,137,904	$2,137,904
SENSITIVE CAPTIAL COSTS	$867,280	$867,280	$867,280
SENSITIVE CAPITAL COSTS * FACTOR	$1,300,920	$1,300,920	$1,300,920
Subtotal (A)	$3,438,824	$3,438,824	$3,438,824
ADJUSTED SUBCONTRACTORS WORK	$343,882	$687,765	$1,031,647
SUBCONTRACTOR'S FEE	$34,388	$68,776	$103,165
BARE, DIRECT FIELD COST	$3,473,212	$3,507,600	$3,541,989
ADJUSTED INDIRECT CONTRACTOR COSTS	$694,642	$1,227,660	$2,479,392
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$4,167,855	$4,735,261	$6,021,381
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$3,955,294	$4,493,762	$5,714,290
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$395,529	$449,376	$571,429
TOTAL ADJUSTED FIELD COSTS	$4,350,824	$4,943,139	$6,285,719
ADJUSTED HEALTH AND SAFETY COST	$130,525	$247,157	$628,572
ADJUSTED CONTINGENCY COST	$435,082	$988,628	$1,885,716
ADJUSTED ENGINEERING COST	$217,541	$494,314	$1,257,144
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$5,133,972	$6,673,237	$10,057,151

ORIGINAL (Red)

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$658,126	$658,126	$658,126
ANNUAL SENSITIVE O&M COSTS	$105,515	$105,515	$105,515
ANNUAL SENSITIVE O&M COSTS * FACTOR	$158,273	$158,273	$158,273
SUBTOTAL (A)	$816,399	$816,399	$816,399
ADJUSTED CONTINGENCY COST	$81,640	$163,280	$244,920
SINKING FUND COST (U/F,TACC,10%,30-yr)	$31,211	$40,569	$61,141
SINKING FUND COST ADJUSTMENT (FOR TECHNOLOGIES THAT WILL NOT BE DECOMMISSIONED -I.E.,PUBLIC WATER SUPPLY SYSTEM,SEEP EXCAVATION)	$7,467	$9,706	$14,628
ANNUAL OPERATION MAINTENANCE COST (O/M)	$921,783	$1,010,541	$1,107,831
PRESENT WORTH (10%,30-yr) ON ANNUAL O/M	$8,689,566	$9,526,286	$10,443,429
TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$13,823,538	$16,199,523	$20,500,580
PERCENT RESPONSE TO ADJUSTMENTS	-14.7%	0.0%	26.6%

AR301245

BERKS SAND PIT
SENSITIVITY ANALYSIS
REMEDIAL ACTION ALTERNATIVE NO.7

Sensitivity Factor For Capital/O&M Costs: 2.00 SENALT74.WK1

CAPITAL COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
NON-SENSITIVE CAPITAL COSTS	$2,137,904	$2,137,904	$2,137,904
SENSITIVE CAPTIAL COSTS	$867,280	$867,280	$867,280
SENSITIVE CAPITAL COSTS * FACTOR	$1,734,560	$1,734,560	$1,734,560
Subtotal (A)	$3,872,464	$3,872,464	$3,872,464
ADJUSTED SUBCONTRACTORS WORK	$387,246	$774,493	$1,161,739
SUBCONTRACTOR'S FEE	$38,725	$77,449	$116,174
BARE, DIRECT FIELD COST	$3,911,189	$3,949,913	$3,988,638
ADJUSTED INDIRECT CONTRACTOR COSTS	$782,238	$1,382,470	$2,792,047
TOTAL UNADJUSTED FIELD COST (FIELD PLUS INDIRECT CONTRACTOR COSTS)	$4,693,426	$5,332,383	$6,780,684
TOTAL FIELD COST (ADJUSTED FOR CITY COST INDEX)	$4,454,062	$5,060,431	$6,434,870
CONTRACTOR PROFIT @10% (APPLIED TO TOTAL FIELD COST)	$445,406	$506,043	$643,487
TOTAL ADJUSTED FIELD COSTS	$4,899,468	$5,566,475	$7,078,357
ADJUSTED HEALTH AND SAFETY COST	$146,984	$278,324	$707,836
ADJUSTED CONTINGENCY COST	$489,947	$1,113,295	$2,123,507
ADJUSTED ENGINEERING COST	$244,973	$556,647	$1,415,671
TOTAL ADJUSTED CAPITAL COSTS (TACC)	$5,781,372	$7,514,741	$11,325,370

OPERATION/MAINTENANCE COSTS	LOW ESTIMATE	ORIGINAL ESTIMATE	HIGH ESTIMATE
ANNUAL NON-SENSITIVE O&M COSTS	$658,126	$658,126	$658,126
ANNUAL SENSITIVE O&M COSTS	$105,515	$105,515	$105,515
ANNUAL SENSITIVE O&M COSTS * FACTOR	$211,030	$211,030	$211,030
SUBTOTAL (A)	$869,156	$869,156	$869,156
ADJUSTED CONTINGENCY COST	$86,916	$173,831	$260,747
SINKING FUND COST (W/F,TACC,10%,30-yr)	$35,147	$45,685	$68,851
SINKING FUND COST ADJUSTMENT (FOR TECHNOLOGIES THAT WILL NOT BE DECOMMISSIONED -I.E.,PUBLIC WATER SUPPLY SYSTEM,SEEP EXCAVATION)	$8,346	$10,849	$16,350
ANNUAL OPERATION, MAINTENANCE COST (O/M)	$982,873	$1,077,823	$1,182,404
PRESENT WORTH (10%,30-yr) ON ANNUAL O/M	$9,265,456	$10,160,545	$11,146,420
TOTAL ADJUSTED ALTERNATIVE COSTS (PRESENT WORTH)	$15,046,828	$17,675,286	$22,471,790
PERCENT RESPONSE TO ADJUSTMENTS	-14.9%	0.0%	27.1%

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DATE OF DOCUMENT 10/1/88

DESCRIPTION OF IMAGERY Study Area and Sampling Locations Sheet No. 1

NUMBER AND TYPE OF IMAGERY ITEM(S) 1 oversized map

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DESCRIPTION OF IMAGERY Feasibility Study - Conceptual Design Sheet No. 2

NUMBER AND TYPE OF IMAGERY ITEM(S) 1 oversized map

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DESCRIPTION OF IMAGERY Options for Alternate water Supply Sources (Sheets 3 of 4)

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DESCRIPTION OF IMAGERY Feasibility Study - Conceptual Design (sheet 4 of 4)

NUMBER AND TYPE OF IMAGERY ITEM(S) Oversized Map